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CATARACT

Senile, Traumatic and Congenital

BY

W. A. FISHER, M. D.

PROFESSOR OF OPHTHALMOLOGY

CHICAGO EYE, EAR, NOSE AND THROAT COLLEGE

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INTRODUCTION

One of the most attractive problems presenting itself to those interested in ophthalmology has been that of opacity of the crystalline lens—its prevention and treatment—which, from an early and quite natural misconception of the pathology of the condition, came to be known and still is described as cataract.

Much has been written in the support and refutation of theories of causation, but we are yet in doubt as to the etiology of all save a very few clinical forms and accordingly little has been accomplished in the matter of prevention. An elaborate classification of forms has come to be accepted, which, however, is of little real value in practice, where it is found that for purpose of treatment primary opacity of the lens falls naturally into one of three groups.

The work that has been done on classification, etiology and prevention does not begin to compare in extent nor brilliancy with that which has been done on treatment on which some of the greatest triumphs of medicine have been scored. It is the purpose of the present volume to review literature of the modern treatment of the condition, especially that of the development of the extraction of the lens in capsule in cases of senile cataract, the credit for first suggesting which seems to belong to Pagenstecher, who, however, left it to later workers to develop methods of operating that are successful in their hands and in those of others who have taken up the work, and finally to give the author's method of intracapsular extraction of senile cataract together with his treatment of the congenital and traumatic forms.

In view of the universal concession that intracapsular extraction with its usual freedom from the necessity of post-operative interference, is the ideal operation, it is unfortunate that this method has not been more generally adopted. The great obstacle in the way of such adoption seems to be the fear of loss of vitreous. Experience has shown that this accident is of less and less frequent occurrence as experience is gained in the operation and that the gravity of the complication is not so great as it is generally thought to be when treated by the methods devised for its management.

A method will be described whereby it is possible to obtain experience in the operation together with that of treatment of its possible complications.

Grateful acknowledgment is made to the various authors and publishers quoted without whose permission much that is pertinent to the subject could not have been made use of.

W. A. FISHER, M. D.

31 N. State St., Chicago.

February 7, 1917.

SENILE CATARACT

A careful study of the literature has elicited the fact that a most concise discussion of the various operative procedures is to be found in "A TEXT BOOK OF OPHTHALMOLOGY," by John W. Wright, M. D., of Columbus, Ohio, the first edition of which appeared in 1896. In this same edition he describes a practical method of intracapsular extraction which he described in an article published in the Ohio Medical Journal in 1884—ten years before the publication of his text book. He continued to perform this operation regularly for thirty years, which entitles him to first place in describing a practical technique for removing a lens in capsule. Wright's operation is not quoted for the purpose of recommending it as being the best method of removing a lens, but because it seemed to be the best at that time and because it will be a great help in bringing out the author's method of operating and dealing with complications that may occur when removing a lens by any method.

Since Wright's discussion is so important, the author has chosen to copy his exact words in the twelve pages that follow:

EXTRACTION OF CATARACT—DIFFERENT METHODS

BY JOHN W. WRIGHT, M. D.

"Since the first operation for extraction of cataract, there have been so many methods devised for its performance, and each one has been tenaciously supported by its originator, that the beginner is bewildered as to which particular one to adopt. Like surgical operations in general, no matter what particular method is employed nor how well the operation is performed—however favorable the condition of the patient—failures come, and frequently when least expected; hence the impossibility of a procedure that is invariably successful. No doubt each method for the performance of the operation has its particular advantages as well as its peculiar dangers. Consequently, a searching study of these various methods should be encouraged, adopting the operation or that part of the operation which has been proven by experience to be advantageous—discarding that which has been shown to be hazardous and dangerous.

By many ophthalmologists it is considered that there are but two methods of extraction: The flap operation and the linear extraction—the others being merely modifications of these two. However, for the purpose of discussing this subject in a practical manner, it will be necessary to take into consideration the following as distinct methods: First, the Flap Operation; second, the Linear Extraction; third, the Modified Linear Extraction, or Von Graefe's Method; fourth, Pagenstecher's Method; fifth, Lebrun's

Method; sixth, MacNamara's Method; seventh, Bell Taylor's Method.

The Flap Operation.—Of the different procedures for the object named, there has been none whose result, when a success, is all that could be desired, so much as in this operation. When everything goes well, the result is almost perfect; the patient has a central, movable pupil and the wound heals with such exact apposition that the normal curvature of the cornea is not in the least impaired; but so many accidents are liable to happen, and the after treatment is so troublesome, that the operation has fallen into disrepute.

Among the many objections which are urged against it are: The tendency to suppuration of the cornea, the vigor of the patient generally being unequal to so large an area of cut cornea; the frequency of a prolapsed iris, forcing the edges of the wound apart; the liability of a reflection of the flap, on account of a slight movement of the eye or the lid after the eye is closed, and before the bandage is applied; imperfect coaptation of the lips of the wound, then there is not union by first intention, but by granulation—thus, the normal curvature of the cornea is interfered with, and, as a result, astigmatism.

The Linear Operation.—This operation having undergone so many modifications, it is now hardly recognized under its old name; it is, in fact, generally described as the Traction Method. As described under the head of Gibson's Operation, it consists in dilating the pupil and lacerating the lens capsule with a needle, as if operating for solution—only the capsule must be more freely incised. A few days after the needle operation, an incision is made in the sclero-corneal border, at its upper part, including about one-fourth of the corneal circumference; a curette is introduced into the anterior chamber and turned edgeways, so as to open the wound in the cornea; then by slight manipulation on the lower part of the cornea, the lenticular matter is allowed to escape. No iridectomy is made.

This operation was attended with considerable danger, in consequence of the swelling of the lens, which, from the pressure exerted by it, caused considerable irritation.

Von Graefe's Modified Linear Extraction.—This operation, sometimes called the Peripheral Linear Extraction, was introduced by von Graefe in 1865. The incision lies considerably beyond the sclero-corneal junction, involving the conjunctiva, of which a flap is made. As recommended by its author, the iridectomy should be made some weeks before the extraction; however, the iridectomy is now almost always made at the time of the extraction. The plain points in the operation are simply these: The incision must be made entirely within the sclerotic—beyond the sclero-corneal border, and an iridectomy must always be performed. The merits of this method were much lauded, and it was confidently hoped that the objections which were attendant upon the flap operation would be overcome. This was in a great degree realized, the advantages lying in the small risk of suppurative inflammation. But with the new advantages came new and

intricate dangers. The near proximity of the incision to the ciliary region caused sympathetic ophthalmia with destructive irido-choroiditis, which was liable to attack and cause the loss of the other eye. There is also great danger of losing the eye by carrying the incision too far into the sclerotic and rupturing the hyaloid membrane, causing an escape of the vitreous humor. Another great disadvantage is the tendency to hemorrhage from the conjunctiva into the anterior chamber, thus obscuring the parts and making further procedure difficult. Even though the operation should be successful, there is another important objection; the sight is imperfect and confused by circles of diffusion on the retina, which is always the case when there is a loss of any part of the iris.

Prof. Pagenstecher's Method differs very little from the flap operation. The incision is made as nearly as possible at the sclero-corneal margin with a Graefe's knife; a large iridectomy is also made. By gentle pressure the lens within its capsule is forced out. If the lens is not readily displaced in this way, then a curette is inserted behind the lens and, by gentle traction exerted on it, it is started from its position. The incision is made downwards.

This method, no doubt, is a valuable one, for where the capsule is removed with the lens, there can be no obstruction of vision from portions of it remaining behind, which frequently happens when the lens is removed in the ordinary way; that is, by rupturing the capsule. The passage of the curette behind the lens is dangerous practice, frequently causing a rupture in the hyaloid membrane and a loss of the vitreous. The eye is also subjected to the same dangers as in the ordinary flap operation.

Lebrun's Method makes the incision entirely within the cornea. The knife is inserted opposite the center of the pupil, about midway between the center of the cornea and the sclero-corneal margin; it is carried directly upwards or downwards—according as it is to be an upper or lower flap—on this same line, and consequently the knife will emerge at a point equidistant from the center of the cornea and the sclero-corneal margin. Iridectomy is not performed and, after the lens is extracted, eserine is employed to prevent anterior synechia.

A moment's reflection demonstrates its peculiar advantages, as well as its disadvantages. The corneal wound being so far from the ciliary body, there is little danger of cyclitis; there is not likely to be a loss of vitreous, nor a wounding of the iris whilst making the section. If there is union by first intention, then, as in the flap operation, we have all that can be desired. However, like the flap operation, it is liable to the same dangers, suppuration of the cornea, a reflection of the flap and imperfect coaptation of the lips of the wound. I am very sure that, in this method, there is more danger of a reflection of the flap than in the flap operation; for, in this case, the flap is thinner and has not the support within itself to sustain it, as has the old flap. The wound is extensive and the healing process necessarily slow, especially in persons of feeble constitutions. The object in making the

wound so far out in the cornea, together with the use of eserine, is to prevent a staphyloma and an adhesion of the iris in the lips of the wound. The use of a myotic in such cases has been discarded by every observant ophthalmologist who has had experience with it. If there ever is a time that myosis should be avoided, it certainly is immediately after the lens has been pressed through the pupil—for the pupillary margin is certainly liable to be bruised, and its tendency is to the promotion of plastic lymph and, as a result, occlusion of the pupil.

MacNamara's Method consists in the extraction of the lens through an incision made at the extreme outer margin of the cornea. The lens is removed by the scoop. The section is made with a broad-bladed, triangular knife, whose point is thrust through the line of junction of the cornea and sclerotic, as before stated, on the temporal side of the eye. The author says: "The blade of the knife is to be passed steadily onwards, nearly up to its heel, so that the incision made through the sclerotic is at least half an inch long." An iridectomy is not made unless the pupil does not dilate; and his aim is to remove the lens in its capsule, particularly if there is much transparent, cortical matter around the lens. If there is much traction necessary in removing the lens in its capsule, then he ruptures the capsule and removes the lens in the usual way.

This operation, although subject to some of the dangers attending the flap operation, is far more practical. Like the flap operation, there is danger of suppurative inflammation, but the author claims he seldom lost an eye in this way. There is certainly very little danger from a reflection of the flap, as the movements of the eye or the lids would have very little influence in separating the lips of the wound.

Bell Taylor's Operation consisted in removing the lens through a peripheral opening of the iris. The incision is made in about the same manner as in the linear method, and the lens is extruded through a gape in the iris gliding behind the pupil. The author claimed "all the advantages in the way of certainty and safety of an associated iridectomy, and the grand desideratum—a central and movable pupil."

The result in successful cases was almost perfect, but the operation was found to be too complicated, much time and great dexterity being required to procure the passage of the lens through the small opening in the iris. The upper portion of the pupillary margin did not always preserve its arc; but, dropping at a point corresponding with the incision in the iris, formed a small and irregular pupil. The operation has, I believe, been abandoned by its author.

Now, from an examination of these procedures, we have learned that the sources of danger are numerous, and frequently, in avoiding one, we are liable to fall into another.

The following may be taken as a summary of some important facts:

That in making an incision we must not encroach too closely upon the

ciliary body—thus avoiding destructive cyclitis and sympathetic ophthalmia, as well as increased liability of rupturing the hyaloid and loss of the vitreous.

That in flap operations there is danger of suppuration, and that the danger increases according as the incision is large and the flap long and unable to support itself.

That the nearer the incision is made to the corneal margin, or sclero-corneal junction, the greater the danger of a staphyloma of the iris.

That the retention of the entire iris with a central movable pupil gives the greatest possible degree of success.

That the wounding of the iris is to be deprecated, unless in a case of exigency, and then as a *dernier ressort.*

That the use of myotics after extraction is detrimental to a favorable result and should be avoided—but on the contrary, the use of mydriatics gives great assurance of the avoidance of dangerous complications.

That the use of the scoop for the extraction of the lens is hazardous and should not be resorted to except in an emergency. The danger lies in rupturing the hyaloid.

That the use of the speculum, if possible, should be avoided for the reason that when the incision is made, the aqueous humor frequently escapes with such rapidity that the hyaloid membrane is ruptured, on account of its sudden loss of support, and the vitreous escapes, frequently before the speculum can be removed and the eyelids closed.

That wounds of the cornea, however slight the puncture or scratch, are not devoid of risk, but the danger is confined to those who are not healthy. On the other hand, if the patient is healthy the less disposed is the eye to take on suppurative inflammation. The most extensive cuts and lacerations of the cornea recover with surprising activity, even in advanced age.

From a careful resume of the preceding, I have endeavored to select a method for extraction which will possess the following points:

An incision that is small and entirely within the cornea, and so made that there is no flap and no gaping of the wound.

Almost entire painlessness, the avoidance of an anesthetic, the speculum and fixation forceps.

A central movable pupil, except in very rare cases, where the pupil will not dilate sufficiently to allow the passage of the lens.

Wright's Operation.—As the principal lesion in this particular operation is in the cornea, and as this is the point wherein this process differs most in importance from all other methods of removing the lens, an occasion presents itself which invites our consideration of some important facts concerning wounds of the cornea in general.

It is well known that there is no scratch or abrasion or puncture of the cornea, however small or seemingly insignificant, which is devoid of risk. On the other hand, there is no wound within certain bounds from which the eye may not recover under favorable conditions, the most important of

which is the vigorous and healthy condition of the patient, which promotes in the greatest degree the restorative powers.

It is generally the case that in wounds of the cornea where it is abraded and a considerable portion of the epithelium is lost, it is more liable to take on suppurative inflammation than from an incised wound.

Considering that accidental wounds of the cornea are mostly inflicted by blunt instruments—pieces of machinery or of stone, glass, wood or belting—the wounds are more frequently lacerated than incised, the epithelium often extensively abraded, the eye itself frequently injured from the concussion and force of pressure from the inflicting body, yet with all these complications it is surprising how very rapidly it heals, what slight inflammation exists after such severe and extensive injuries, and how small the cicatrices resulting from large and intricate wounds. Where vision is lost in these cases, it is not frequently because of opacity of the cornea, but mostly from occlusion of the pupil, because it was not kept under the influence of a mydriatic, or else from opacity of the lens as a result of the concussion the eye received at the time of the injury.

How much more rapidly then should these wounds heal when made by a clean, sharp instrument, in the absence of a heavy shock, or concussion, and of the dirt and extraneous matter usually present in cases of accident!

But it is not so with the sclerotic. It cannot be wounded with such impunity. When this structure is injured, however simple and small the wound, the danger is great and the eye is almost always lost. The reasons for this are few and simple. It is apt to be complicated with a prolapse of the choroid and ciliary body into the wound, and as it cicatrizes, sympathetic irido-choroiditis is established in the other eye, and we are necessitated to remove the wounded eye in order to save the other.

The nearer the choroid, ciliary body and retina are approached, either designedly or accidentally, the greater the danger of losing the eye from the resulting inflammation.

Taking these facts into consideration, I have attempted to obtain the highest possible degree of success, by making the necessary wound in a part as remote as possible from the seat of danger and where the tendency is to heal rapidly—avoiding that structure which is most liable to dangerous complications; hence I have adopted the plan of making the incision entirely within the cornea, and at a distance as remote as possible from the sclerotic.

Having our patient ready, we will then proceed to the operation, first by dilating the pupils. I usually drop a four per cent solution of cocaine in both eyes every minute, for ten minutes. The pupils will dilate much better if the solution is dropped in both at the same time.

If at the end of ten minutes the pupils have not become well dilated, a one per cent solution of atropin should be dropped into the eye every

five minutes for half an hour; at the same time the cocaine solution should be continued sufficiently often to keep up its anesthetic effect.

If the pupil has dilated well in the eye upon which we desire to operate, we will not make an iridectomy; however, if to the contrary it has not dilated well, we must be very sure to make an iridectomy. This, I claim, is an important point. If the pupil appears sluggish and does not dilate fully and promptly, then it is very important that we make an iridectomy, for by so doing we will prevent an occlusion of the pupil.

Where the pupil dilates freely and promptly, there is no danger of iritis or an occluded pupil, unless the anterior chamber is filled with lenticular matter and fragments of the capsule.

THE OPERATION

(The following description in the first edition of his text of 1896 is practically the same including the illustrations as that given in his paper in 1884, which was written for the express purpose of making more clear his preliminary report of his technique published in 1881.)

For convenience we imagine a transverse horizontal line one-third the way down the upper edge of the cornea. A medium sized Graefe's knife is used in making the incision. The point of entrance must be ***near the sclero-corneal border,*** but entirely within the cornea, on the imaginary line, as is shown in the dotted line in Figure 1.

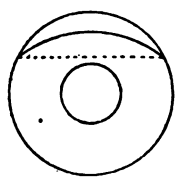

Fig. 1. (Fig. 24 Wright.)

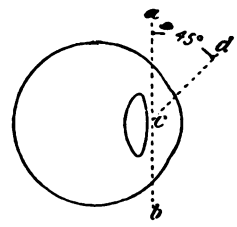

Fig. 2. (Fig. 25 Wright.)

The cutting edge of the knife is directed upwards and forwards, the plane of the knife making an angle of about 45 degrees with the plane of the normal iris, as is shown in Figure 25 (Figure 2) (The line a b represents the plane of the normal iris; c d the plane of the knife.)

The back of the knife must be kept on the imaginary line and the counter-puncture made near the sclero-corneal border at the point of entrance. The knife is now steadily and gently pushed forward until the section is completed. The line of incision will now present the apperance of the curved line in Figure 24 (Figure 1).

The patient is now allowed to rest a moment, when, if the pupil has not dilated well, the iridectomy is made. On the other hand, as has been

indicated before, if the pupil had been fully dilated before the incision was made, the iridectomy is to be omitted.

The next step in the operation, as usually practiced, whether an iridectomy has been made or not, has been to rupture the capsule of the lens; but I am fully satisfied that, *as a rule, the lens is easily removed within its capsule,* and especially so in this particular operation.

Dr. MacNamara in commending this procedure says: "The advantages it offers are, that no capsular cataract can possibly form, and there is no chance of any soft lenticular matter being left clinging to the iris and setting up inflammation in that delicate structure; and the greater my experience in these matters, the more convinced I am that most of our failures in extraction are due to the fact of soft lenticular matter and capsule being left in the eye after the removal of the lens."

I am disposed to this opinion, that there would be very few cases of iritis as a result of these operations were it not for these portions of lenticular substance and capsule which are allowed to remain, and which it is frequently impossible to remove, because of the danger in losing the vitreous.

We will then without rupturing the capsule take the next step in the operation, which is to press down the upper segment of the cornea with the finger as is represented in Figure 3. At the same time, if the lens does not readily present itself, slight pressure with a finger of the other hand may be made near the sclero-corneal border below, which is also shown in Figure 26 (Figure 3).

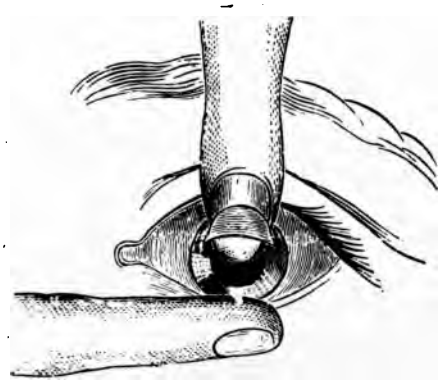

Fig. 3. (Fig. 26 Wright.)

If now the lens does not readily present itself and pass out, we may rupture the capsule, and again proceed to make pressure as has been directed. The lens will now present itself and pass through the opening as represented in Figure 26 (Figure 3).

I have found this procedure much better and safer than by making the pressure with a curette or scoop, as was formerly recommended. The

surgeon who once uses his fingers in the manner here described, will doubtless never hereafter resort to an instrument for the purpose of making pressure. In this way the eye can be handled with much more safety and comfort to the patient, and with greater facility to the operator.

I rarely am compelled to make pressure below the incision at the sclero-corneal border, more than to steady the eye whilst the pressure is being made on the upper segment—for the lens usually passes out as soon as the pressure above is sufficient to make the opening large enough to allow its passage.

The advantages gained by this procedure are evident.

By other methods sufficient pressure is made below the incision to make the wound gap enough to allow the lens to pass, frequently rupturing the hyaloid membrane and causing a loss of the vitreous—whereas, in this method, the opening that is made by pressing down the upper segment, as indicated, is sufficiently large—if the incision has been properly made—to allow the ready passage of the lens.

This mode of operation presents other manifest advantages:

It is the smallest possible incision that can be made, that will allow the ready passage of the lens.

The incision is made in that structure which is most likely to heal and least liable to take on dangerous complications.

The manner in which the incision is made prevents its gaping, hence there is no danger of a staphyloma of the iris.

There being no flap, and the incised surface being small, danger of suppuration of the cornea is reduced to a minimum.

Even if the wound in the cornea should leave an opaque cicatrix, it is covered by the upper lid, and does not interfere with vision in the least, but, as a rule, the cicatrix clears up perfectly, and in a short time cannot be detected with the naked eye.

On account of the pressure on the upper segment of the cornea, the corresponding portion of the iris is so pressed upon that the lens is brought immediately to its point of exit through the pupil, thus preventing its slipping up behind the iris, and bruising the ciliary body, with the resulting consequences.

Acting upon the principle of not removing any structure which can be retained without interfering with the result of the operation, in most cases we retain the entire iris, and thus secure the advantages of a central movable pupil.

The operation being almost painless, is reduced to the greatest simplicity, not requiring an anesthetic, speculum, fixation forceps, and frequently but one instrument—a Graefe's knife.

In this, as in all other important operations upon the eye, thorough asepsis is of paramount importance; therefore, all instruments, dressings and bandages should be thoroughly sterilized, in the most approved manner.

Cutting instruments should not be boiled, nor immersed in the bichloride of mercury solution to render them aseptic, for the former will destroy the temper, and the latter will cause them to rust. If the instruments have been thoroughly washed and dried since having been used, it is quite sufficient to immerse them in absolute alcohol when you operate.

Immediately before the operation, the eye should be thoroughly flushed with a 1-1000 bichloride solution of mercury; this should also be done immediately after the operation is completed, when the lids should be dried and the dressings applied.

Before the dressings are applied, we should be very sure that all extraneous matter is removed from the anterior chamber, that no part of the iris is intruded into the corneal wound, and that the lips of the wound are perfectly adjusted.

The dressings should consist of oval pieces of sterilized cotton wool, sufficiently large to cover the eye, and held in position by a roller bandage, applied with enough firmness only to give the eye sufficient protection and support. This is an important matter; if the eye is too tightly bandaged, it is liable to cause the wound to gap.

It is necessary to cover both eyes, for the reason if one eye is exposed, and the patient can use it, the bandaged eye will move with it whenever the exposed eye moves.

My rule has been not to annoy the patient by making an examination of the eye until the third day after the operation, unless he is suffering pain or some inconvenience, in which case the eye is examined sooner. But on the third day the bandages are removed, the secretions are washed away from the edges of the lids in both eyes, the eye operated upon is examined, and if the cornea is clear, and the iris and pupil easily seen, we may be reasonably sure of success.

If on the third day everything is favorable, there is very little danger of any trouble thereafter, if the patient will take the proper care of himself. He must keep his bed and talk as little as possible for a few days yet. After the fifth or sixth day after the operation he may be allowed to sit up a few hours every day, and in ten days, if everything goes well, he may be allowed some outdoor exercise.

Contingencies liable to occur in cataract extraction:
Loss of vitreous.
Lenticular matter in anterior chamber.
Iris caught in wound.
Suppuration of cornea.

1. *Loss of vitreous.*

While the loss of a small amount of vitreous during the operation is not usually a matter of very great consequence, yet if a considerable

amount is lost, it is of serious importance, for the reason that the retina, having suddenly lost its support, becomes detached.

If at the moment the lens passes through the opening a sudden gush of the vitreous follows, the eyes must be closed at once, and the patient cautioned not to move them and to keep perfectly quiet until a compress, secured by a bandage, is applied over both eyes.

Great caution must be observed in making pressure upon the eye in the attempt to force the lens through a small opening. When it is found that the opening is too small, we should enlarge it rather than to take the risk of rupturing the hyaloid.

2. *Lenticular matter in the anterior chamber.*

Frequently, in removing a cataract, a considerable amount of cortical substance remains in the anterior chamber, and it is a matter of great importance that it should be removed, as its presence is very liable to excite an inflammatory action which would compromise a satisfactory result.

It often occurs that the cortical substance is clear, while the nuclear portion of the lens is opaque, in which event it is not readily detected. Should the eye be dressed without its removal, the surgeon will be surprised at his next visit to find the pupillary space filled with lenticular matter, which has become opaque from the action of the aqueous humor upon it. Nothing can be done now except to keep the pupil well dilated and its edges as far from the extraneous matter as possible until it absorbs.

If much lenticular matter is allowed to remain in the eye, it is very liable, even in our greatest effort, to keep the pupil dilated, to cause an occlusion of the pupil, besides a long course of inflammatory action in the eye, involving the choroid and retina to such an extent as to render futile an operation for artificial pupil, with the contemplation of useful vision as a result.

The eye, therefore, should be examined very carefully before it is dressed, and should the pupil not appear perfectly clear, gentle stroking with the spatula upon the cornea will cause the cortical substance, or any loose lenticular matter within the anterior chamber to pass out through the lips of the wound.

3. *Iris caught in the wound.*

If any portion of the iris protrudes, or is caught within the lips of the wound, it should be carefully replaced. This is readily accomplished by a slight rotary motion made by the finger over the closed upper lid.

If at our first examination of the eye, on the second or third day after the operation, we find the iris is protruded through the lips of the wound, an attempt to replace it would be futile, and we can have no preference in the matter but to snip it off as near the cornea as possible. This procedure should be observed at each dressing thereafter, as long as any portion of it projects from the wound.

4. *Suppuration of the cornea.*

Suppuration of the cornea is one of the worst after complications

which can possibly follow in the wake of an operation for the extraction of cataract, and once precipitated, the eye is lost beyond redemption.

Suppuration may come on so insidiously and without any pronounced symptoms, that we are not cognizant but what the eye is doing well, until we make an examination preparatory to dressing it, when we are surprised to find the cornea hazy, the edges of the wound separated, presenting a grayish-yellow appearance, and other evidence indicating the formation of pus.

The suppuration, however, may, and often is, attended by violent pain in the eye and over the supra-orbital region, with oedema of the lids and swelling and oedema of the conjunctiva.

Soon a profuse muco-purulent discharge will begin, and all hope of saving the eye, with the prospect of useful vision, is vanished.

We must now set to work at once to check the inflammatory action, else it will extend to the iris, the ciliary body and the choroid, precipitating a panophthalmitis which is certain to destroy the globe.

Prompt action is required. The eye must be flushed with the bichloride solution, 1-1000, and hot water fomentations must be applied over the eye and surrounding parts for at least an hour at a time, and repeated two or three times a day, after which warm cotton wool should be placed over the lids, and secured with a loose bandage.

At the same time the patient should have a good nourishing diet, with wine or brandy, if weak and anæmic. If suffering severe pain an anodyne should be administered."

(The only reference to this description of Dr. Wright's technique found in the literature occurs in Wood's American Encyclopedia of Ophthalmology.)

Wright has thus far been quoted freely because he is the first ophthalmic surgeon who described a method of removing a lens in capsule that he considered safer than the capsulotomy method and had the conviction to stick to it all his life; he like Smith worked out his own technique. Wright's technique has been described fully, not because it is perfect, or is the best at this time, but it has the appearance of being the best at that time.

After Wright, Smith seems to be the only other operator who had sufficient confidence in his own technique to adopt it as a routine. Some of Smith's students, including the author, have endeavored to make his technique more simple and safer in our hands. Vail of Cincinnati and the Greens of San Francisco having devised methods of holding the lids away from the eyeball, which is a very important point.

Wright of the United States and Smith of India have made the only advances worth while in the cataract operation that have been made within the last half century.

Besides quoting freely from Wright and giving Smith the credit for the technique to be described, quotations are made from deSchweinitz

and Weeks of our own country, who are considered as good as any we have, and also from authors in foreign countries who are considered the greatest ophthalmologists in their respective fields. The operators quoted are experts, and have a technique which seems perfect in their hands, and for this reason, if for no other, they may not be justified in changing their technique, but how can the world change unless the teachers lead the way?

The fear of loss of vitreous has always been the thing that has kept competent operators from even attempting the removal of a lens in capsule and rightly so if a scoop must be placed behind the lens to lift it out. It seems incredible that any one could operate a half dozen times in that manner without finding it impossible. It will be noted from a consideration of the following pages, "lifted" verbatim from the standard texts—not only from the earliest to the most recent editions of deSchweinitz and Fuchs; but from the recent editions of the others quoted the fear of loss of vitreous is the one great reason advanced for the non-adoption of intracapsular extraction.

Quoting deSchweinitz (published by W. B. Saunders Co.) we find in the first edition, that of 1892, the following:

"EXTRACTION WITHOUT CAPSULOTOMY—Some surgeons, as a rule, deliver the lens without opening the capsule, and the operation is applicable to cases of over ripe cataract and high myopia with vitreous changes.

Pagenstecher, its chief advocate, makes his section in the lower half of the cornea by an incision placed in the sclerotic one millimeter from the corneal edge. Iridectomy is performed and the lens is delivered in its capsule, with a loop, or especially devised curette. The chief danger of the operation is the risk of extensive loss of vitreous. The visual results are very good in successful cases."

IN THE EDITION OF 1899, he states: "Cataracts may be extracted with the capsule: A. and H. Pagenstecher have tried this operation as a general method, but had to limit it to hypermature cataracts where the capsule is thickened and the zonula Zinnii frail or ruptured. For such cases it is the best method."

EDITION OF 1902—"EXTRACTION OF HARD CATARACT—It would be impractical to indicate the numerous modifications which have been employed in this operation, than which, as Dr. Noyes says, no surgical procedure has been more carefully studied and elaborated in detail. Hence only these methods which the author is accustomed to employ will be described."

(A) Extraction without iridectomy.

(B) Extraction with iridectomy.

(C) "Extraction without capsulotomy is performed by some sur-

geons—that is to say, the lens is delivered without opening the capsule. The operation finds its chief indication in cases of over-ripe cataract and in cases of high myopia with vitreous change. Pagenstecher, under these circumstances, makes his section in the lower half of the cornea by an incision placed in the sclerotic, 1 mm. from the corneal edge. Iridectomy is performed and the lens is delivered in its capsule with the loop or a specially devised curette. The chief danger of the operation is the extensive loss of vitreous."

The visual results are very good in successful cases. In the few cases in which the author (deSchweinitz) has performed this operation he has delivered the lens with a loop after iridectomy through a section made in the cornea-scleral junction.

IN THAT OF 1906 there is an exact copy of the discussion in the edition of 1902 with addition of the following: "Many ophthalmic surgeons of great experience in India believe that extraction in the capsule should be the operation of election (Major Henry Smith)."

IN THE EDITION OF 1910 under treatment of Immature Cataract he says: "According to Major Henry Smith, D. W. Greene and a few other surgeons, the best means of managing immature cataract is its extraction in the capsule by the so-called Indian or Smith method. The stage of immaturity at which Smith advocates the extraction of immature cataract in its capsule is where the opacity has progressed so far as to unfit the patient for the performance of his ordinary duties. With this operation the author has had no experience."

He also repeats the discussion of 1906—with addition of the following: "If the operator desires to perform extraction in the capsule, Major Smith's operation, also called the Indian operation according to Smith, he may proceed as follows: After a liberal sized upward incision the speculum is removed and an assistant holds the upper eye lid on a large sized strabismus hook and draws down the lower lid with his thumb. The lids must be kept in this position until the operation is completed, an iridectomy may or may not be performed. Next the curve of the strabismus hook is placed over the cornea, about the junction of the lower with the middle third of the lens, and a spoon or spatula just above the upper lip of the wound. The strabismus hook is pressed down neither toward the wound nor from it, and does not alter its position until the lens is nearly out, and during this time slow, steady and uninterrupted pressure and counter pressure must continue. When the lens is more than half way out the operator, while keeping up the tension with the spoon in its original position, shifts the strabismus hook forward and gently tilts the lens by getting the edge of it in the concavity of the strabismus hook. After the lens is removed in this manner, the eye lids are released and the usual dressing applied. If vitreous has escaped it is snipped off with scissors, and if the iris prolapses it is replaced before the lids are released—that is,

if the operation has been performed without the aid of iridectomy. (Archives of Ophthalmology, p. 604, 1905.)

This operation has proved remarkedly successful in the hands of Major Smith with his unrivaled opportunities and enormous experience. It has met with opposition from other surgeons, who consider the difficulty of its performance and the danger of prolapse of the vitreous too great. In this country it has been especially advocated Dr. D. W. Greene, who has performed it with admirable success. It would seem that immediately after this operation there is much more conjunctival congestion than after the usual extraction; that striped keratitis is frequent, and that the danger of loss of vitreous is a serious drawback.

According to Greene, three points must never be lost sight of, pressure should never be excessive, but steady and equal, the cornea must be kept moist, and there should be no pressure or rubbing over the center of the cornea." In a footnote he refers to Smith's and Greene's articles for treatment of complications.

IN THE 1913 EDITION: He repeats the discussion of 1910 on the treatment of immature cataract and, in his section on operations, we find: "Within the last few years Colonel Henry Smith's method of extraction of cataract in the capsule (radical operation for cataract according to Vail) has attracted much attention.

SMITH'S OPERATION FOR THE EXTRACTION OF CATARACT: (Indian method of the Extract of Cataract in the capsule.) The operation is performed as follows: This description condensed and slightly modified is taken from D. W. Greene's quotation of Colonel Smith's own account of his operation.

After a spring speculum has been inserted, the eye being fixed with special forceps, a Graefe knife is entered at the corneo-scleral junction and counter puncture made in the corneo-scleral junction of the opposite side, so that the incision when completed shall include half or nearly half of the circumference of the cornea. The knife is driven through the heel, the handle being lowered as it passes onward and the point elevated.

If the manipulation is a proper one, after the counter puncture is made the knife cuts as it goes through the tissues, and the incision is completed with one thrust, the incision ending in the cornea in such a manner that the edges of the corneal wound are cut as nearly as possible at right angles to the surface. An iridectomy may or may not be done, but it is advisable, for the beginner at least, to make this part of the operative procedure.

The speculum is now removed, and the eye lid and brow are held away from the eye by means of a large blunt hook and the assistant's

fingers. (Figure 327 deSchweinitz [Figure 4]). The patient is required to look steadily upward. In the case of an immature lens or of a hard cataract the operator next presses back with the point of a strabismus hook toward the optic nerve, the point of the hook being placed over the lower third of the cornea. This pressure must be steady, and the point of the hook

Fig. 4. (Fig. 327 deSchweinitz.) Smith's operation for cataract: Spectator's view, while the lids are being held by the assistant and the hook for expelling the lens is applied. Notice the gable-like space under the upper lid above the eyeball. The operator may look obliquely under the upper lid in this field and get a good exposure of the entire upper culdesac. The assistant can shift this exposure to the right or left to enable the operator to have an unobstructed view of the lens and wound; also to give him access to the angles of the wound and the summit when replacing the cut sides of the iris, and the apron of the iris that adheres to the scleral wound after delivery. (Description and illustration by Vail.)

Fig. 5. (Fig. 328 deSchweinitz.) Smith's operation for cataract: Shows where the bulbous end of the lens hook is applied in the act of pressing to expel the lens. The pressure is made "straight back toward the optic nerve," not quickly or plungingly, but with intelligent and bold onward pressure, never varying the direction of the pressure until either the lens breaks from its moorings above or below and shows a disposition to be delivered, in which case the exit is favored by shifting the pressure, or the lens stubbornly refuses to yield and advance because of tough ligaments or small size of the incision. (Description and illustration by Vail.)

should not be removed until the upper edge of the lens tilts forward. The moment the lens is seen to be dislocated, the pressure through the point of the hook is gradually turned more and more toward the wound, pressure during all this time being maintained, so as to keep the lens up to the sclerotic margin, the pressure with the hook becoming gradually lighter and lighter and the hook gradually sliding under the lens until the cornea is folded beneath it. At this stage the lens is delivered. (Figure 4.) (Figure 327 deSchweinitz.)

If the tension of the eye is low, the emerging lens should be followed with a spatula as well as with a hook, and sometimes, in these circumstances, a light counter pressure with the spatula above the wound is indicated.

In the case of intumescent lenses and Morgagnian cataract, the cap-

sules of which are extremely delicate and liable to burst, pressure with the point of the strabismus hook is made sufficiently deep over the lower border of the lens to cause it to dislocate below and turn a half summersault, the pressure and traction always being made over the zonula. As soon as the lens turns up into the wound the operator ceases to make traction toward the patient's feet and directs the pressure backward, next backward and upward, and finally more and more toward the wound, folding the cornea beneath the lens until it falls out of the cornea. As the capsule has not yet been dislocated from the zonula in the neighborhood of the wound, the hollow of the curve of the strabismus hook should now be made to sweep along between the lens and the wound to complete this detachment. It is advisable in these circumstances to keep up sufficient tension on the eye ball with the spatula placed on the cornea in order to prevent the lens from slipping back into the eye.

Hypermature cataract is difficult to dislocate, and the operator should proceed with the strabismus hook as in the case of immature and hard cataract, but a spatula in his left hand should be in position at the margin of the wound to drop behind the lens the instant its edge appears. As it is dropped almost straight down into the eye, the back of the spatula must be placed against the sclerotic margin of the wound and the lens pressed against it with the hook from the outside. The lens, therefore, slides along the inclined plane of the spatula.

Great care should be taken to return the iris to its proper position, whether or not an iridectomy has been made, and with a suitable repositor the operator should release any part of the iris from the sclerotic or from the angles of the wound. If this is carefully done, the eye need not be dressed until the expiration of the eighth day, and many of the complications which have been described may be attributed to meddlesome dressings and meddlesome inspections. If vitreous escapes it should be nipped off with scissors in the usual manner.

According to Col. Smith, cataracts occurring in children and young persons are not suited to this operation, because it is practically impossible to dislocate their lenses. The operation seems to be valuable in unripe cataract, and in those forms of cataract which are immature and which require long periods of time for their complete opacification. Much difference of opinion exists as to the value of this operation, and its permanent place in surgical practice. In our own country the operation has been particularly recommended by Dr. D. W. Greene, Derrick T. Vail, and A. Timberman, who have had large opportunities of learning the technic on Colonel Smith's clinic in India. It has also received the commendation of Robert Sattler.

One of the objections to the Indian operation is that the percentage of loss of vitreous is much higher than in the ordinary extraction of cataract. Colonel Smith has reported his vitreous loss to be eight per

cent, while Vail, in a series of uncomplicated cataracts, did not exceed two per cent of vitreous loss, and, therefore, he believes, to use his own expression, that vitreous escape is not the argument to be used against Smith's technic.

Naturally the ordinary accidents of cataract extraction are liable to occur; but apparently in Smith's Indian service they are not greater than those which occur in ordinary extraction. It is the author's impression, based on a very limited experience and upon the observations of operators who are familiar with the Smith technique, that while this operation may have a place in ophthalmic surgery, especially in the extraction of unripe cataracts, it is not likely to drive from the field those procedures which have for years been firmly and favorably established."

IN THE 1916 EDITION: He repeats the discussion of 1913, including the author among those who endorse the operation, giving him credit for modifications and having devised a lid elevator and adds the following:

"Several operations for the extraction of cataract in capsule after subluxation of the lens with capsule forceps have been devised. Stanculeau's operation, which has been commended by Simpson and Howard Hansell, in its main features is as follows:

"After an incision in the limbus somewhat larger than the usual one, a sickle shaped forceps is entered into the anterior chamber, and a fold of capsule is grasped within its branches. By horizontal, upward and downward movements the zonula is ruptured. When the operator feels that the lens has been dislocated, the forceps is withdrawn, and the lens is expressed in the usual manner with the aid of the two spatulas.

ARNOLD KNAPP'S METHOD IS AS FOLLOWS:

"After the usual preparation and the instillation of one drop of atropine, under holocain anesthesia, the Koster speculum is introduced and left in place until the operation is completed, unless there is danger of an actual prolapse of vitreous.

"An assistant is necessary only in the presence of complications. The section must be large and should be just short of half the corneal circumference with a conjunctival flap. After the iridectomy, the capsule forceps is introduced to a point below the centre of the pupil, the branches are then allowed to separate broadly, and a knuckle of capsule is grasped. The grasp should not be too tight, lest the capsule be torn, but sufficiently firm to exert traction on the periphery of the lens capsule. The closed branches of the forceps are gently moved from side to side, up and down, rotated, and the capsule can be seen to follow in the various directions. When the dislocation has succeeded, a part of the margin of the cataract in the capsule appears below, generally slightly to one side or the other, with the upper attachment unruptured. The forceps is then released and withdrawn. Pressure is exerted straight back on the lower part of the cornea with Smith's hook, and the cataract can be seen to

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now Lieutenant-Colonel, Henry Smith of H. M. Indian Medical Service, and many pilgrims now visit him at this station as they once sought V. Graefe to learn the new operation. The technique of his new operation, which he performed so many thousands of times, differs essentially from that of any method heretofore suggested. Its object is to remove the cataract within its capsule. Both a skilled operator and a skilled assistant are requisite for success. After the eye has been cocainized, the upper lid is drawn up so as to expose the transition fold, which is then thoroughly irrigated with a stream of 1-2000 solution of sublimate. This, Smith believes to be necessary in India, where a healthy conjunctiva is the exception, but, as he stated to the writer, he sees no reason why it should be a routine procedure in countries when a healthy conjunctiva are the rule. A speculum is introduced and a large section made in the cornea, avoiding a conjunctival flap. The speculum is then removed. The assistant then introduces a large strabismus hook beneath the upper lid and lifts it out from the eyeball, at the same time pressing up the brow with the ring and little fingers of the hand holding the hook, so as to control any contractions of the corrugator super-cillii and depressing the lower lid with the thumb of his other hand, the palm of which lies on the cheek. The patient maintains the normal position of the eye, looking upward throughout the operation. The operator holds in his right hand a smaller strabismus hook, or lens hook; in his left, a small spatula. With the hook he presses on the lower third of the cornea to rupture the zonula and press the lens up through the section, while he holds the spatula ready for use, if needed, to assist in causing the lens to move by pressure on the sclera below or to hold back the vitreous by introduction into the wound. In the majority of cases the upper zonula is ruptured first and the lens is delivered with its upper edge forward, but in a large minority the lens 'tumbles' and emerges lower edge first. The toilet of the wound consists of the replacement of the iris. The operation may be performed with or without iridectomy. It is preeminently suited for the extraction of immature cataracts."

(The above is from the pen of the translator.)

QUOTING FROM WEEKS' TEXT-BOOK, 1910—(Lea and Febriger):

Major H. Smith (Indian Medical Gazette, Febr., 1907; Trans. Am. Ophthal. Soc., 1908) has practiced extraction of the lens in the capsule in many thousands of cases. His method is largely original. While the operation is expeditious and well adapted to the East Indian, it does not apparently possess sufficient elements of safety to render its employment advisable in the countries in which good vision is more necessary.

"MAJOR SMITH'S METHOD OF CATARACT EXTRACTION.—The following is the method employed by Major Smith of Jullundur, India, for the removal of cataract in individuals over thirty years of age:

INSTRUMENTS.—Small spring speculum without stop; fixation forceps; Graefe knife; scissors and forceps for iridectomy; a broad, firm spatula, and two rigid hooks much like strabismus hooks, one with a shorter shank than the other.

OPERATION.—Local anesthesia is employed. Patient in the recumbent position, the operator standing back of the patient's head. The speculum is introduced and permitted to separate the lids by the strength of the spring. The eye is fixed by grasping episcleral tissue just below the lower margin of the cornea. Section with a Graefe knife, the puncture and counterpuncture being in the horizontal meridian 1 mm. from the corneal margin of the sclera. The incision is a modified Lebrun usually ending in the cornea 1.5 to 2.5 mm. from the upper corneal margin, finishing with the edge of the knife directed forward at right angles to the corneal surface. An iridectomy is made. The iris is seized at the apex of the incision without entering the eye if possible, drawn out moderately and excised. The fixation forceps and speculum are now removed, the lower lid, brow and upper lid secured and held from the globe by an assistant. The upper lid is held by means of the shorter of the two hooks. The lid is drawn upward and slightly outward. Pressure is now made by the operator, by means of the point of the other hook, at the lower part or margin of the cornea directly backward toward the centre of rotation of the eyeball over the lower third or fourth of the lens. If the lens is to come out without being reversed, this pressure (which should be firm and continuous) is kept up until the lens starts, when the direction of the pressure is changed to follow the lens.

If the prospects are that the lens will be reversed before presenting at the wound, the detachment of the capsule from the zonula below is facilitated by dragging down on the cornea while making the pressure. As the lens starts, pressure is made so as to get beneath the lens and to assist the turning. As the lower edge of the lens presents in the wound, pressure is directed upward, care being observed to follow the lens closely. If the lens does not readily engage the wound, slight pressure is made on the upper lip of the wound with the spatula. When the lens is well engaged in the wound it may be assisted out by means of the hook, with which the pressure is made. The iris is now replaced, the margins of the wound placed in proper apposition, and the eye bandaged.

During the expression of the lens, the eye takes any position that it may rotate into. No attempt is made to have the patient look in any direction.

The reported cases show 4.5 to 7 per cent of loss of vitreous; very little iritis.

QUOTING SWANZY AND WERNER (P. Blakiston's Sons' Co.) TEXT-BOOK, 1915:

"EXTRACTION IN CAPSULE.—The ideal cataract extraction is that in which the opaque lens in its capsule is removed, thereby obviating all

subsequent trouble due to the capsule. The objection which has prevented the method from coming into general use is the great danger of prolapse of vitreous which must attend it, owing to the liability of the hyaloid membrane to be ruptured during delivery of the cataract. The operation has been performed by ophthalmic surgeons from time to time, and has been especially cultivated in India by Major Henry Smith. His incision lies in the cornea about 3 mm. below its upper margin, the puncture and counter-puncture being in the corneo-scleral margin as peripherally as possible. The speculum is then removed and the assistant raises the upper lid with a strabismus hook, at the same time drawing the eyebrow and upper lid upward with firm pressure of the fingers, while the lower lid is drawn down with the other hand. The curve of a strabismus hook is placed upon the cornea in its lower third, and a Daviel's spoon just above the upper edge of the wound. With these instruments, gentle pressure and counter-pressure are made, until the lens is more than half delivered; it is then tilted with the hook and the delivery is completed. The operation may be done with or without iridectomy, but must be performed slowly and cautiously, else the capsule may be ruptured and the object of the method frustrated. Major Smith in a large number of cases had loss of vitreous in only 6.6 per cent. This method is still on its trial in Europe and has not met universal approval."

SUMMARY OF AUTHORS QUOTED

de SCHWEINITZ': TEXT-BOOK, 1892.—Describes the lens being removed with a loop with the chief danger being loss of vitreous. In 1899 he describes the same technique. In 1902 he has operated a few times by extracting with the loop. In 1906 the same. In 1910 he says he has had no experience with the Smith or Indian method, but the danger of vitreous loss is a serious drawback. In 1913 he has no personal experience with the intracapsular operation, but gives a good, short description of the operation, which he repeats in 1916, but expresses his belief that while it has a place, it will not drive from the field those procedures which have for years been firmly and favorably established.

FUCHS: TEXT-BOOK, 1892.—Only discussed the spoon or scoop. In 1899 and 1908, the same. In 1911 he gave a brief description of Vail's work in the Smith operation, but the translator, in a footnote, said: "Many doubted whether the final results are as good as extraction with capsulotomy." In 1913 he describes the same technique as outlined in 1911.

AXENFELD: TEXT-BOOK, 1915.—Whom many of us know personally, believes it would be useless to adopt a procedure he did not even describe.

ROEMER: TEXT-BOOK, 1913.—Did not even mention the intracapsular operation, but his translator gave it one-half page, but such a short description would only make others believe it was not worth mentioning.

SWANZY AND WERNER: TEXT-BOOK, 1915.—Give a good, short description of the intracapsular operation, but state that it is on trial in Europe and has not met with universal approval.

WEEKS: TEXT-BOOK, 1915.—Gives a good, short description of the operation and decides that it is a good operation for the East Indian but not safe enough for our people.

The reason so many operators of such high standing are quoted is to try and point out the reason why the intracapsular operation is not more highly recommended and so little thought of by so many who are so clever. It must be that the ones quoted have not had the opportunity of operating in this manner and are too conscientious to try it out.

The author believes this to be the reason and is glad to note that the fear of loss of vitreous is the greatest drawback because this can be reduced to a minimum.

If an operator tries to operate by the intracapsular method without first understanding the lid hooks and having a better technique of removing a lens than by a wire loop when a slight loss of vitreous appears before the lens is delivered, he will surely come to grief.

The author believes that such operators as he has quoted, and many others, can readily adopt the intracapsular operation as a routine practice with better results than by the old method if they would only operate upon enough kittens to master the spatula and needle. This technique is described on page 67.

The author believes it the safest method of removing lenses by amateurs because they can get any amount of practice necessary to make their first operation with more confidence than by any method he is familiar with. Emphasis must be placed upon three important points for success after a cataract operation by any method:

FIRST: Control of the lids with lid hooks, which are safer than any form of speculum, and an assistant can readily acquire a good technique for his part in the operation by practice upon human eyes and become quite expert before a cataract operation is begun.

Special emphasis should be given this point because of its importance and because material is abundant. (See page 35.)

SECOND: The incision is important and good practice can be obtained by operating upon four-week-old kittens' eyes, which are quite similar to those of the human.

THIRD: Loss of vitreous can be reduced to a minimum by becoming familiar with the Smith spatula and author's needle upon kittens' eyes.

The three suggestions mentioned apply to a cataract operation by any method performed by an expert or a novice, and, if mastered, the intracapsular operation would not appear as difficult as it now seems to be.

With the resume of the literature generally on the subject of intracapsular extraction, the author will now describe in detail the method as practiced by Lt.-Col. Henry Smith, with the author's modification, and to give a method of acquiring technic, which materially diminishes the dangers generally feared.

FISHER'S MODIFICATION OF THE SMITH-INDIAN OPERATION FOR SENILE CATARACT

It is admitted that if loss of vitreous and post-operative inflammation can be avoided in the extraction of a lens and the technique adopted is applicable to the early stages of cataract, thus saving the patient the weary months of ripening, we are approaching an ideal cataract operation, inasmuch as we expect normal vision in every case where the cornea is clear and the fundus normal. The method that will come nearest this ideal should be the operation of choice.

Much has been said for and against the removal of the lens in capsule, but all operators seem to agree that its removal in that manner would be the ideal operation, providing it could be done without serious loss of vitreous or other complications.

The profession has a deep-seated impression that loss of vitreous is very common in the Smith-Indian operation, that has caused it to offer objections to that method. If this complication could be avoided, the removal of the lens in its capsule would become the operation of choice.

An escape of vitreous when a cataract operation is being performed is considered a complication to be avoided, especially before the lens is delivered, at which stage it is very serious indeed, because the lens must yet be delivered with the probability of further loss or injury to the eye.

With the old technique, a spoon or wire loop is passed into the eyeball and the lens is lifted out. Such a procedure, even in the hands of an expert, must of necessity be the cause of blindness in many cases.

If the loss of vitreous occurs after the lens has been delivered, the complication is not so serious, because the operation is finished with the exception of cutting off the protruding humor.

It is impossible to prevent loss of vitreous in all cases by all operators by any method as yet proposed, but the percentage can be made as low or lower by the method to be described as would occur if the so-called classical technique were pursued. The author realizes that loss of vitreous and other complications may occur when a cataract operation is performed by an

inexperienced operator, whatever method of operation is selected, and the one endeavor will be to make possible for a beginner, as well as for a finished operator, the acquisition of a technique whereby their occurrence is reduced to a minimum.

DANGER TO THE EYE: One of the greatest sources of danger to the integrity of the eye from a cataract operation by any method lies in the use of the speculum. No operator can tell when the patient will squeeze his lids together and, if pressure is made upon the eyeball by the lids after the incision has been made, grave and irreparable complications may occur before the speculum can be removed.

In all eyeball operations the use of Fisher's lid hooks will materially lessen this danger. They will be described and urged upon all operators both skilled and inexperienced, for this and all other operations when the eyeball is opened. Proper handling of these instruments is so essential that, while not a difficult thing to learn to do, the student is urged to master their use upon the eyes of patients in whom local anesthesia has been induced for other purposes rather than to attempt to acquire skill in their use at cataract operations, a procedure certain to be accompanied by disastrous consequences. When the operator has mastered this technique, he can easily teach his assistant by the same method.

When the use of the lid hooks has been mastered by the operator and also by those chosen to assist him, he is ready to take the next step, which is the acquisition of skill in the use of the Smith spoon and Fisher's needle in assisting in the delivery of the lens in kittens' eyes secured in a suitable mask which will be described later.

It is imperative that this technique be obtained in this manner, for human eyes are too precious for such practice and it should be mastered before an attempt be made to remove a lens by any method.

If the technique of holding the lids is understood and the use of the Smith spoon and Fisher's needle are mastered, the operator will be in position to remove a cataractous lens with as few accidents as possible.

The technique to be described is a modification of the Smith-Indian operation and is based upon twenty years of active work in the capsulotomy method, and seven hundred intracapsular operations, five hundred seventy-six of which were performed in Amritsar, India, under the direct supervision of Lt.-Col. Henry Smith.

The following description of a cataract operation is based upon the author's modification of Smith's operation and will deal with the immature cataract operation first, after which the mature and hypermature, with their complications, will be dealt with separately.

It has been demonstrated that the Smith technique is not impossible for those less skillful than he, because those who have had personal experience under him have become enthusiasts bcause of the results obtained, and the author feels that knowledge of this technique should be more general.

Unfortunately it is impossible for all operators to receive personal instruction from the originator of the technique, but a method will be described by which any operator may become proficient in its use without having subjected a single patient to the dangers incident to operation by a novice.

The author is indebted to Col. Smith for the principles of this technique, because without the ideas received from his personal instruction in India he could not have made these modifications. He is also indebted to Dr. D. T. Vail of Cincinnati, Ohio, for his accurate description of the operation and for his beautiful drawings, and, with his permission, some of them are described.

CAUSES OF POOR VISION: The three great causes of poor vision after cataract operations are:

First, loss of vitreous, which can be greatly reduced by abandoning all kinds of specula.

Second, post-operative inflammation, which is often caused by shreds of capsule remaining in the corneal wound which can be prevented by discarding cystitome and capsule forceps.

Third, infection which is often caused by tardy healing or opening of the wound after it is partially closed, and healed, the infection usually being caused by opening the eye too soon.

THE OPERATION: It is assumed that the patient has had a thorough physical examination and his general condition does not contraindicate a cataract operation, that a culture from the conjunctival sac has been made and found negative, that the pupil reacts to light, that the patient is upon the operating table ready for operation and the instruments have been prepared for the operation. The reader should be especially warned of the impracticability of removing a cataractous lens in the hope of improving vision from an eye that does not have both perception and projection, and in which there is not an active pupillary reaction, since the latter may usually be taken as an indication of the visual possibility of a cataractous eye.

INSTRUMENTS: The necessary instruments in the order in which they will be required are: Fisher upper and lower lid hooks, fixation forceps without catch, knife, iris forceps, iris scissors, Smith hook, Smith-Fisher instrument (always held in operator's left hand during the lens delivery but not used in uncomplicated cases) and iris replacer. A large dissecting forceps should be at hand for use in the removal of shreds of capsule or cortical substance from the wound if required when the capsule is ruptured.

A cataract operation requires very fine technique and, with so little opportunity to familiarize one's self with it, the author has decided to minutely describe the various steps of the operation, illustrating freely with drawings. To prevent confusion, the technique described and illustrated will be that of an immature cataract in the right eye, after which that for

the left will be given, and after that the operation for mature and hypermature will be described.

ANESTHETIC: Three or four drops of a freshly prepared 4 per cent solution of cocain are instilled into both eyes and the outer half of the lashes of the upper lid of the eye to be operated are cut close. The face and closed eyelids are scrubbed with soap and water and recleansed with bichloride of mercury 1-2000, care being taken not to get any soap or bichloride into the eye before it is thoroughly cocainized. Three minutes after the first instillation of cocain, 10 drops of a 2 per cent cocain solution is injected under the conjunctiva, just above the sclero-corneal junction, where the iridectomy is to be made, and the same amount below, where the fixation forceps grasp the eyeball. Two minutes after the injection, 3 or 4 drops of a 4 per cent solution of cocain is instilled into the eye, followed by 3 or 4 drops of 1-1000 adrenalin. Three minutes after the last instillation of cocain; the eye is ready for operation.

Fig. 6. Author's Upper Lid Hook.

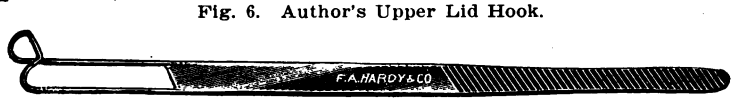

Fig. 7. Author's Lower Lid Hook.

Fig. 8. Lid Hooks in Position.

Fig. 8. First Step in the Operation: Introduction of Lid Hooks. The first assistant stands upon the left side of the patient, holding the upper lid up and away from the eyeball with the double lid hook. (Fig. 6.)

The instrument is held in his right hand like a writing pen, the last two fingers resting upon the patient's nose. The forearm should be held up to give the operator room to pass his left hand around that of the assistant.

The lower lid is held down by the same assistant with the lower lid

hook (Figure 7) held in his left hand. A second assistant or nurse holds the brow up by pressure with the thumb. (Figure 8.)

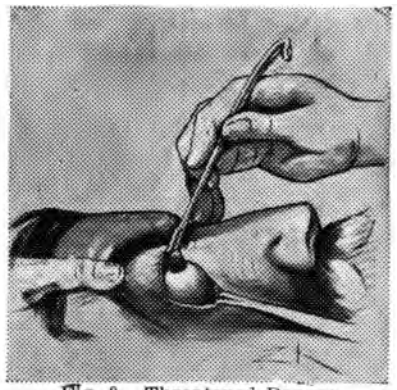

Fig. 9 Threatened Danger.

Fig. 9. If the patient is nervous or there is impending or actual loss of vitreous, the position of the lid hook is changed to pull the lid down, which takes all pressure away from the globe. Compare with Fig. 8. The two prongs of the hook are caught behind the cartilage and there is then no danger of the instrument slipping out, but the lid must not be pulled down enough to cause the patient pain.

This part of the technique can be easily mastered by practice on an eye that is anesthetized and it is very important that the assistant knows when to do this and how to do it.

In an operation without any complications, this latter position is not made use of, but the one illustrated in Figure 8 is used from the beginning of the operation until finished and the eyes closed.

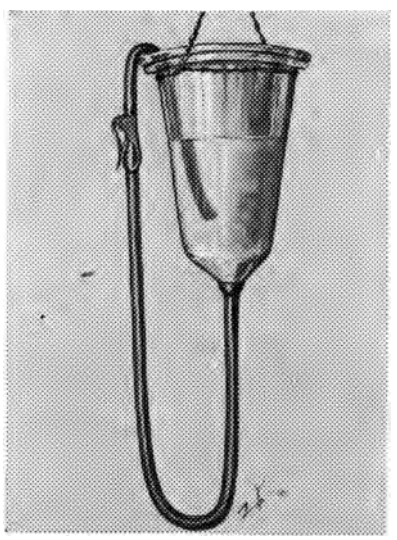

Fig. 10. Irrigator.

Fig. 10. Cleansing the conjunctival sac. While the lids are held as in Fig. 8 the eye is flushed with the bichloride solution from the irrigator, since this can be done better and quicker by this means than by any other method. The irrigator should be suspended from the ceiling with its bottom about seven feet from the floor; one-half inch rubber tubing with a cut-off at the distal end, and long enough to reach to the eye, should be attached to it.

Three ounces of a warm solution of 1-2000 bichloride of mercury which should be twenty-four hours old is allowed to flow into the conjunctival sac, after which the excess is removed with a sterile medicine dropper.

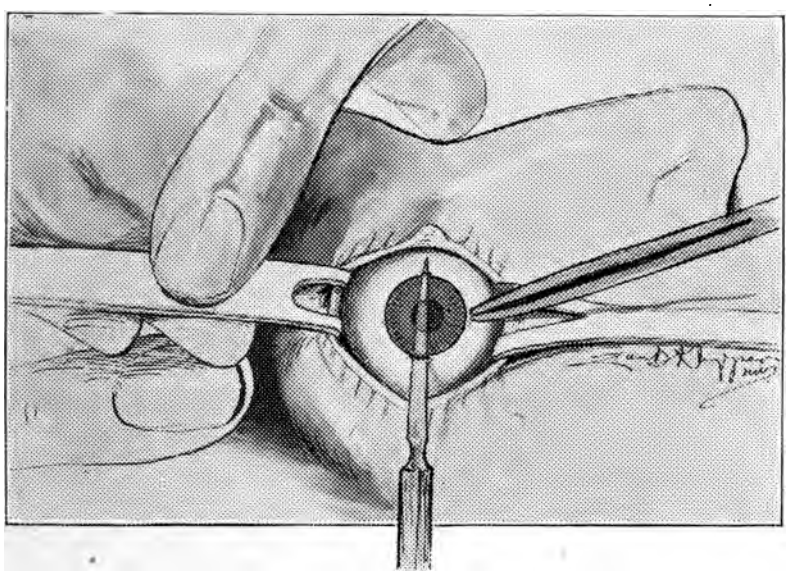

Fig. 11. The Incision.

Fig. 11. The Incision. The first and second assistants are in position as described in Fig. 8. The lids are held apart as they would be if a speculum were used, the upper lid hook holding the upper lid far enough from the eyeball to keep pressure from it.

The operator grasps the eye as near the lower margin of the cornea as possible with fixation forceps (Figure 12) and holds the knife (Figure 13) as he would a pen. The blade of the knife and the plane of the iris form an angle of 15 degrees.

Fig. 12. Fixation Forceps.

Fig. 13. Smith's Modification of Wilson Knife.

The puncture is made as deeply through the limbus as is commensurate with safety when the knife passes across the anterior chamber with its back in the center of the pupil and the counter puncture is made as deeply as possible.

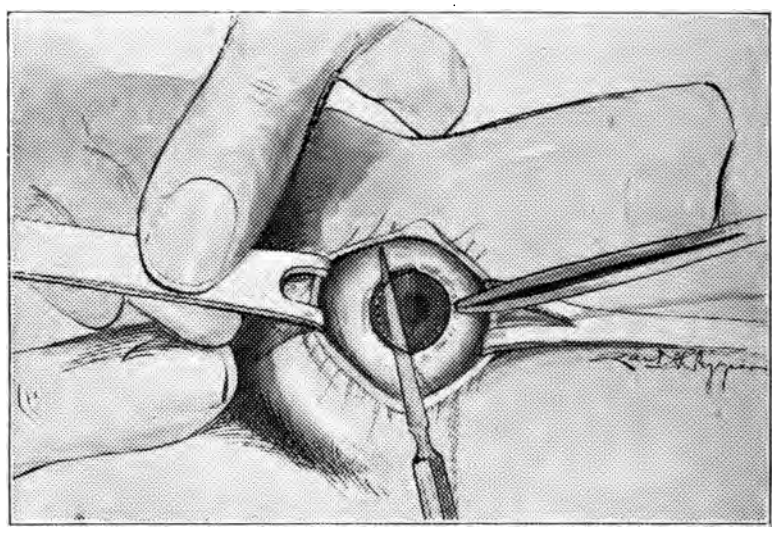

Fig. 14. The Incision (Continued).

Fig. 14. The handle of the knife is depressed as soon as the point is engaged in the counter puncture in order to cut as little conjunctiva as possible. In this manner one-half of the cornea is cut, the puncture and counter puncture being as deep as possible, making an opening for the removal of the lens as large as it can be made.

The incision is finished in the cornea about two millimeters from the sclero-corneal junction, and, if possible, with one upward and forward sweep of the knife.

If the incision cannot be finished with one sweep, one sawing movement is allowable; though one forward sweep is always desirable because it leaves two smooth edges while a to and fro movement is more apt to leave ragged ones.

A conjunctival flap is never made, but the incision is always confined entirely to the cornea, coming out two millimeters below the sclero-corneal junction. The corneal incision thus made by one forward motion of the knife leaves two smooth edges to unite, there being seldom any astigmatism, and the wound heals rapidly.

The conjunctival flap does not seem to have any advantage over the corneal incision, is more difficult to make, and is impossible of completion with one forward sweep of the knife.

THE KNIFE: The knife used is the Smith Modification of the Wilson model (Figure 13), because it has been found best adapted for this purpose and its straight flat back materially reduces the danger of intro-

the blade edge downward.

The point should never be tested on a membrane, which dulls it materially, but should be tested directly on the cornea.

If the puncture can be made without dimpling of the cornea, the knife is in proper condition and, with care, one knife will be found satisfactory for many operations without sharpening.

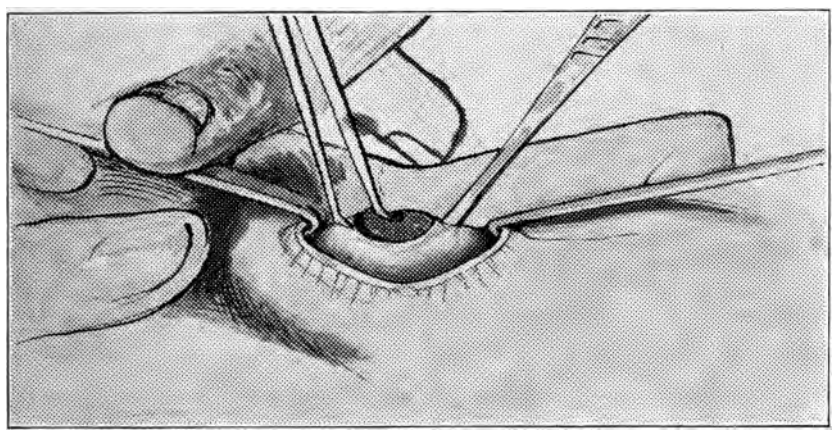

Fig. 15. The Iridectomy.

Fig. 15. The Iridectomy: The first and second assistants continue in the same position as they were when the incision was made and a third assistant fixes the eye with fixation forceps without catch.

The operator stands upon the right side of the patient and makes an iridectomy according to Smith, which is done by placing an iris forceps without teeth (Figure 16) perpendicularly upon the cornea, the upper blade resting upon the upper edge of the corneal wound, and the lower blade on the cornea just below the upper edge of the pupil when it is gently moved upward with a little pressure forcing the iris into the forceps with which it is grasped and excised with the iris scissors (Figure 17).

Fig. 16. Iris Forceps.

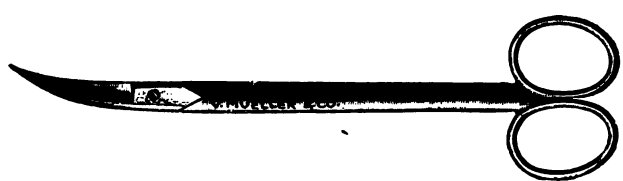

Fig. 17. Iris Scissors.

The iris may be grasped, pulled out, and cut by any one of the various iris forceps upon the market, but the Smith method is preferable because the iris forceps are not introduced into the eye and because there is less danger of rupturing the capsule.

A few trials with the iridectomy, according to Smith, will soon convince a good operator of its simplicity and efficiency.

Some operators are bold enough to make an iridectomy without fixation trusting that the patient will hold the eye quiet, but this is hazardous and should be avoided.

The third assistant should always hold the eye with fixation forceps without catch while the iridectomy is being made.

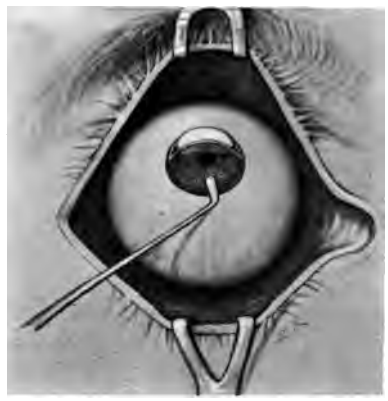

Fig. 18. First Step in Immature Lens Delivery

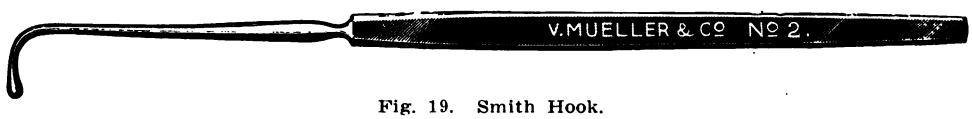

Fig. 19. Smith Hook.

Fig. 20. Smith-Fisher Instrument.

Figure 18. First Step in Immature Lens Delivery: The First and second assistants are in position as described in Figure 3. The operator stands upon the right side of the patient as when doing the iridectomy. This is important, because he can see the whole field of operation by looking up under the lid even if the patient looks up.

patient is not requested to look down as in the old operation and,

if not spoken to, will naturally look straight ahead or up, which is a safer position for lens delivery.

The operator holds the Smith hook (Figure 19) in his right hand as he would a pen, and in his left hand which has been passed around the first assistant's forearm he holds the Smith-Fisher instrument (Figure 20).

The Smith hook is placed flat upon the cornea, the point being half way between the lower edge of the pupillary area and the lower sclero-corneal junction (Figure 18) and pressure is then made steadily backward (Figure 21) toward the optic nerve with the point rather than with the heel.

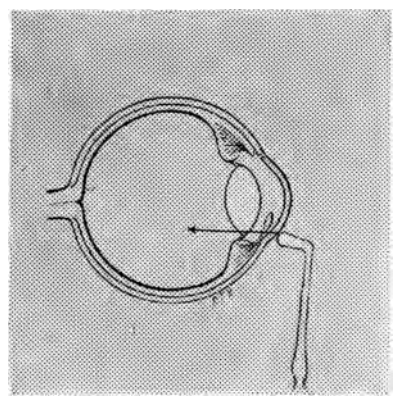

Fig. 21. Direction of Pressure. (Vail: Hook Should Lie Flat.)

When the zonula breaks above, the lens will be seen presenting in the corneal wound (Figure 18). Pressure is continued toward the optic nerve, when, if a good incision has been made and the lens is not too large the presentation will be unobstructed.

Should more pressure be required than can thus be exerted, the hook is rotated until its heel is brought to bear on the sclera and the pressure continued in the same direction. This procedure according to Col. Smith is preferable to the exertion of counter pressure above the incision by means of any instrument held in the left hand.

Fig. 22. Second step in immature lens delivery. The lens is passing the equator and very gentle pressure is kept up with the hook, which must be held lightly in the fingers. As soon as the lens has passed the equator a little pressure is made upward, when it will either remain in this position or be completely delivered. At this stage of the delivery the lens should not be touched with the point of the hook or pushed out of the wound with it, because of the danger of rupturing the capsule.

Fig. 23. Third step in Upright Lens Delivery. If all has gone well and the lens is hanging in the wound, the operator slowly and deliberately passes the hook around it, keeping the point upward to prevent the rupture of the capsule and at the same time keeping the point of the hook from entering the corneal wound.

The hook is now drawn gently along the corneal wound under the lens when it is delivered. The extraction is now complete and the next step is the toilet (Figure 24).

Fig. 24. The Toilet.

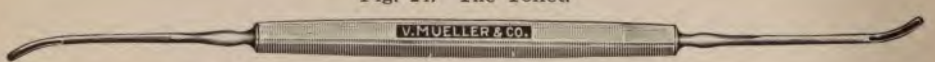

Fig. 25. Smith's Iris Replacer, Two-Thirds Size.

Fig. 24. If the operation has progressed to this stage without accident, the only things remaining are the toilet and the bandage. The toilet is an important part of a cataract operation and the iris replacer (Fig. 25) should be deliberately used. With the patient looking up, the instrument is passed into the corneal wound, replacing the angles of the iris if caught.

It is not only unnecessary, but even dangerous to have the patient look down during any part of a cataract operation and the replacing of the iris is facilitated by having the patient look up; if the patient looks

down the iris has a tendency to be crowded into the wound, which is to be avoided.

OPERATION FINISHED: The operation is now complete and ready for the bandage, the patient is told to close the eyes gently and keep them closed, the first assistant meanwhile removing the lid hooks, remembering always to remove the upper one first, but under no circumstances to remove either hook until the patient has closed his eyes.

THE BANDAGE: The bandage is an important part of the technique and the greatest care should be taken in its application, guarding especially against any kind of pressure.

The eyes are first freely covered with carefully prepared yellow oxide of mercury ointment, grains eight to the ounce, squeezed from a tube, applying it above rather than below the palpebral fissures and with a small amount over the brow (Figure 26), after which the dressing is applied.

Fig. 26. Ointment Applied.

Fig. 27. Dressing Applied.

A large dressing is preferable, consisting of sixteen thicknesses of gauze, which, while amply protecting is not enough to produce pressure and cut long enough to cover both eyes and notched at the nose to prevent its slipping (Figure 27).

Finally a wet starch bandage is applied and allowed to set (Figure 28).

After a few turns of the bandage have been taken, the portion over the operated eye should be reinforced by the introduction of a square of

Fig. 28. Starch Bandage.

gauze well impregnated with sodium silicate (Figure 29), after the application of which the bandage is completed, taking care not to draw it too tight. (Figure 30.)

Starch bandages may be too loose for security or too tight for com-

Fig. 29. Reinforcement of Dressing.

Fig. 30. The Completed Dressing.

fort when set, and, therefore, should be inspected as soon as dry and adjusted by cutting under the ears and sitching the two ends together, making it snug.

THE AFTER-TREATMENT: The patient is put to bed and requested to keep as quiet as possible for twenty-four hours, after which he is allowed to go to the toilet and change from one position to another as his comfort may require; to prevent misplacement of the bandage he is cautioned to lift the head from the pillow before turning it.

Any reasonable freedom may be given after twenty-four hours, such

as sitting up in bed, or in a chair, but told that the bed is the best place most of the time.

The corneal wound usually closes soon after the operation and the bandage may be omitted from the unoperated eye at the end of the second day. After inspection of the closed lids, the operated eye is again covered with yellow oxide ointment and a large dressing applied, taking care not to have it thick enough to cause pressure, with the protector in position (Figure 31).

Fig. 31. Protector.

The protector (Figure 31) is cut from the reinforced portion of the original dressing and will be found stiff enough to provide security, especially because of its having been molded to fit the face of the wearer and has the further advantage of lightness of weight. It is retained in position by means of strips of adhesive plaster (Figure 32), which may be loosened at the side for inspection of the lids if the eye feels uncomfortable, but the lids should not be opened unless there are indications for it, nor should the protector and dressing be disturbed at all until the ninth day, unless the patient complains.

Fig. 32. Protector in Position.

The dressing, however, should not be omitted from the operated eye if the patient is comfortable until the ninth day, when the wound is usually closed, the anterior chamber reformed and the eye quiet. Dark glasses are ordered and the patient discharged in a week without any further treatment.

He is instructed to call for glasses about two months after the operation, or if more convenient get glasses from his nearest oculist.

THE FIRST DRESSING: If, at the first inspection of the operated eye, on the ninth day after the operation a prolapsed iris is noted, the protector and dressing should be replaced for four days more and the prolapse then cut off.

Fixation forceps should not be used when a prolapsed iris is being incised because of the danger of opening the wound and inviting infection.

If the anterior chamber has not reformed and the wound is not firmly closed at the first dressing, it should be rebandaged and not inspected for four days.

Too much treatment is very undesirable, and, if a good operation has been performed, post-operative inflammation will be rare and any kind of treatment will be proper, except removing the bandage daily and inspecting the eyes.

If the lids are swollen at the first dressing the eye should be carefully inspected and the cause found if possible. Salts or some aperient water should be given, a leech applied to the temple, seven and one-half grains of urotropin four times a day, a one grain blue mass pill three times a day and hot applications thirty minutes at a time every two hours, providing they can be given with strict asepsis, but it should not be attempted unless it can be done without danger of producing infection.

Two drops of a one per cent solution of atropin and two drops of a ten per cent solution of dionin should be dropped into the eye every four hours. Fifteen grains of salicylate of soda every four hours will often allay pain and should be given if the pain is persistent.

If the wound is gaping with capsule or vitreous between its lips, it should be cut off with scissors while the lids are held away from the eyeball by the lid hook, but the eye must not be held with fixation forceps at this time. The eye should then be bandaged for four more days to allow healing to take place.

HOW LONG SHOULD THE PATIENT REMAIN IN BED: There is a great difference of opinion as to how long the patient should remain in bed. There is no objection to his doing so the most of the time for nine days if he is comfortable; but there is no reason why he should not be up if more comfortable. However, there is no advantage in having him up and dressed or omitting the bandage from the operated eye till the ninth day if the eye is comfortable.

INFECTION: If there is pus infection, which is exceedingly rare, twenty drops of 1-4000 cyanide of mercuy injected subconjunctivally after preliminary cocainization and repeated as often as the reactions subside and cauterizing the corneal wound is recommended by some.

An infection following a cataract operation is a very grave condition even when everything possible has been done for the patient, but the author believes most of the infections are produced by after treatment and the over-zealous desire of the operator to prevent it. Fisher reported (Ophthalmology April, 1914) three pus infections in 576 operations operated by him in Amritsar, India, in the fall of 1913. (See page 81.)

These patients were operated at their first visit to the clinic without any preparation except cleansing of the eye and the surrounding tissues. They, like other human beings, are quite inquisitive and often move the bandages to see how much vision they have.

In this report one pus infection in about two hundred operations was found, and if such results as this can be obtained among the dirty and ignorant people of India where ninety per cent have trachoma, we should be able to practically eliminate it.

On May 12, 1916, Fisher reported ninety-four consecutive operations before the Mississippi State Medical Society without a single pus infection (see page 101), and he attributes its absence largely to non-interference after the operation.

EXCUSE FOR REMOVING THE BANDAGE: It is not imperative that the first dressing of the operated eye remain nine days, but it may be changed any time it becomes displaced or uncomfortable for any reason, but no good and much harm may follow too early inspection of the eyeball.

Too frequent dressings are certainly undesirable, and when changes are necessary strict surgical cleanliness must be observed.

DELIRIUM: Will seldom be encountered if the bandage is omitted

Fig. 33. Patient and Nurse in Delirium.

from the unoperated eye at the end of the second day, providing the patient can see with it. Some operators prefer to remove the bandage from the operated eye, but the delirium usually found is that of loneliness and if a special nurse is placed upon the case the delirium will usually be harmless.

If a bandage is tied to each wrist of the patient and the nurse attaches herself to the other end of the bandage (Figure 33), both nurse and patient can sleep without danger to the eye. If the patient suddenly tries to pick at his bandage the motion of his hands wakens the nurse, the patient is then spoken to and again goes to sleep. The author prefers this treatment rather than removal of the bandage altogether.

TAKING AND RECORDING VISION FOLLOWING THE OPERATION: The author has observed that it is the custom of the majority of ophthalmic surgeons to pay little or no attention to the vision after cataract operations until the patient is ready to be discharged and that case histories often contain no record of the vision, even at the time of the patient's discharge. For his own satisfaction the vision should be taken frequently and recorded in the history.

FIRST RECORD OF VISION: After the inspection of the eye following the removal of the dressing, if the anterior chamber is reformed and the iris is not prolapsed, the patient should be seated with his back to a window with the curtains opened sufficiently to moderately illuminate the room and the greatest distance at which he can count fingers determined and noted.

No further effort at determining the amount of vision present should be made at this time, but the room should be immediately darkened and the tension determined per finger tips, the excess of ointment removed and smoked glasses put on.

From this time on, the vision should be taken and recorded just as carefully and frequently as the daily inspections are made, making use of the plus ten sphere and pin hole.

During the last few days in the hospital in addition to the use of the sphere and pin hole, the eye should be refracted carefully, but the correction found must not be given, because the refractive condition may change while the eye is assuming the permanent state, and to avoid the encouragement of using the eye until it has become absolutely quiet.

Careful observance of the above will be a source of satisfaction to both operator and patient when everything goes well, a valuable aid in post-operative complications, and will give the operator a sense of security in the event of any subsequent involvement of the operated eye.

OPERATION UPON THE LEFT EYE: The position of the first and second assistants are the same as when operating upon the right eye, except that the first assistant rests his last two fingers upon the patient's temple instead of the nose, while the operator stands at the left of the patient while making the incision with his right hand.

He then assumes his position upon the right side of the patient, makes the iridectomy, and delivers the lens with the handle of the hook lying across the patient's nose in the same manner as has been described when operating upon the right eye.

A description has been given of an uncomplicated immature cataract in its capsule such as is attempted by Colonel Smith in Amritsar, India, in all cases of senile cataract, and this usually can be done successfully in that manner by those skilled in the Smith technique. There are, however, certain critical periods pregnant with grave possibilities in the course of the operation. They will now be discussed with the technique for their treatment.

ACCIDENTS AND COMPLICATIONS

EYE SPECULAE DANGEROUS: Eye speculæ and small corneal incisions are responsible for most of the accidents, but there are a few which are unavoidable. Some of these may be charged to the patient, when, for instance, he suddenly looks downward after a beautiful operation is finished, thus sometimes causing loss of vitreous. Most of the accidents, however, are due to the operator and can be avoided.

The same accidents and complications may occur when performing the so-called classical cataract operation as in the intracapsular, but post-operative inflammation rarely follows the latter method.

The complication most likely to occur is illustrated in Figure 34, where the lens is just presenting in the wound and where it may have a tendency to remain even after prolonged safe pressure has been applied.

This stage of the operation is a very critical one, and unless familiar with its treatment operators of large or small experience will have serious complications.

When the incision is being made, the iris may be cut or the point of the knife prick the skin causing pain, and, if a speculum is used, the patient may squeeze the eye and cause thereby serious trouble.

The operator may produce a serious accident at the completion of the incision by making too great pressure with the fixation forceps, causing loss of vitreous.

The iridectomy may cause pain and some operators are bold enough to cut the iris without having the eye held with fixation forceps by an assistant. It is much safer to have the eye fixed during this procedure.

The use of the needle may cause some ruptured capsules, but the percentage will not be high. When the operation is performed without the use of the needle, or when, after its use the capsule is not ruptured, a good intracapsular operation will have been performed.

When the lens refuses to be born the needle is used: there is very little danger of vitreous loss, providing the lids are properly held, and,

if the capsule is ruptured, a better operation results than if a cystitome or capsule forceps has been used; because many post-operative inflammations following cataract operations are due not to retention of the capsule within the eye, but rather to shreds of capsule being caught in the corneal wound.

This does not occur frequently when the needle is used, because it is not inserted until the lens is presenting and the zonula has been broken.

If the zonula is broken when operating upon an immature cataract and then the capsule ruptures, it has a tendency to fall or be drawn down and away from the wound because the support from above has been broken.

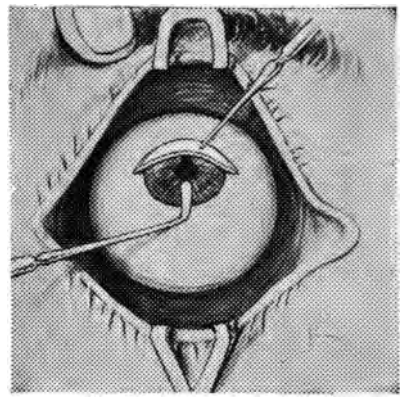

Fig. 34. Author's method of removing the lens when it refuses to be born or a slight loss of vitreous has preceded lens delivery.

To make the Smith operation possible to operators not having had the opportunity of Smith's personal teaching and at the same time to rob it of the dangers of loss of vitreous, Fisher's needle was devised.

If the lens presents in the corneal wound, but will not come forward without what is considered by the operator as unsafe pressure, the needle, which is always held in the left hand and ready for such an emergency, is stuck into the lens which is lifted gently past the equator and the operation may then be finished, as in Figure 23.

Operators who have mastered the Smith technique will seldom use the needle or spoon, but if it is necessary to aid the delivery of the lens with the needle it should not be used until the upper part of the lens has presented, when obviously the zonula has ruptured above.

If the needle is used at this time or later and the capsule is ruptured, the lens will be delivered and the capsule will naturally fall or be pulled down and away from the wound, when shreds of capsule are not likely to become caught in the corneal wound, producing post-operative inflammation. The presentation or the loss of a small amount of vitreous with the lens is not a contraindication for the use of the needle, but rather an indication for its immediate application.

WHEN SHOULD THE NEEDLE BE USED: The author advises the use of the needle when the lens does not come forward after safe pressure has been made; but the more skillful the operator the less often will he be called upon to use the needle.

While the needle is seldom used, it is safer to have it ready to assist in the delivery of the lens if this cannot be effected with safe pressure.

Having it at hand will also make one less timid about the pressure, since it can be safely used after a drop of vitreous has been lost.

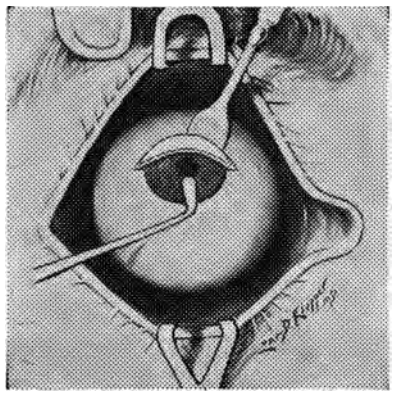

Fig. 35.

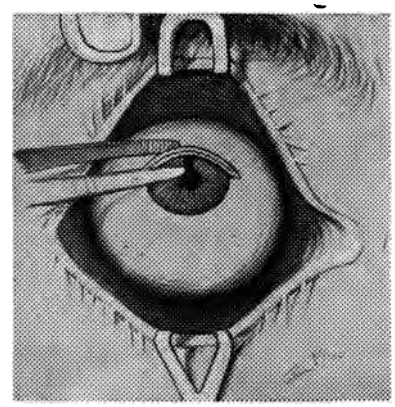

Fig. 36.

Fig. 35. Smith's method of removing the lens when loss of vitreous has preceded delivery: The first and second assistants continue in the same position (Fig. 8). All pressure with the hook is removed and the Smith spatula is deliberately passed down behind the lens.

When the spatula is well in place, pressure is again made with the hook toward the lower end of it. The pressure as above applied is obviously not upon the vitreous, but upon the spatula the position of which is not changed until the lens has been delivered.

The only part in the operation that the spatula performs is to be pressed upon, thus protecting the vitreous and acting as an inclined plane over which the lens slides.

The author prefers the use of the needle as previously described (Figure 34) in dealing with this complication and resorts to the use of the spatula only when he is not able to effect the delivery with the former.

If the capsule is ruptured and lens matter or capsule remain in the corneal wound a large dissecting forceps (Fig. 37) is one of the best instruments with which to remove it. (Fig. 36.)

Fig. 37. Large Dissecting Forceps.

The forceps are not passed into the eye, but over the lips of the

wound with a little pressure, when the soft material is made to pass out of the eye and is grasped by the forceps and removed.

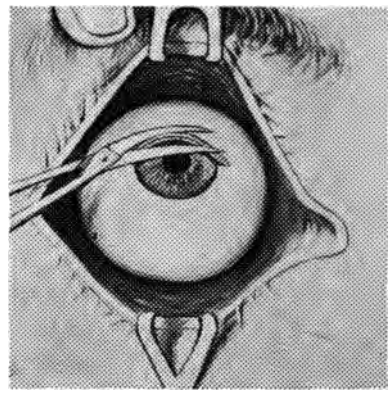

Fig. 38. Cutting Off the Vitreous.
Fig. 38. If any vitreous remains in the wound after lens delivery it should be cut off with scissors.

The first and second assistants are in their original positions and the patient looking forward when any protruding vitreous may be cut off.

When making the puncture and counter-puncture it is possible that the knife be inserted with the cutting edge downwards. This, however, is very unlikely to occur if the flat back Smith Modification of the Wilson Knife is used. If it is inserted upside down it can be withdrawn and the operation finished the next day, when the anterior chamber will be reformed.

MATURE OR HYPERMATURE CATARACTS

TUMBLERS: A description of the delivery of a lens in the upright position, the one in which immature cataracts are usually delivered, has thus far been described. However, some lenses that are mature or hypermature and consist of soft material can be made to "Tumble." If an inexperienced operator thinks a mature lens will tumble, he can attempt the operation in this manner, and, if the zonula will not break below, he can change his technique and make his pressure backward toward the optic nerve and deliver as in the upright method, or according to the technique for immature cataract.

To make the zonula break below and have the lens tumble (come out lower side first), the pressure must not be made in the direction of the optic nerve as described under the immature method, but toward the patient's feet. The point of the Smith hook should be placed perpendicularly upon the lower edge of the cornea, when it will be caught on the ciliary ridge as represented in Figure 39. Steady pressure is made not as in the upright delivery, but rather by pulling toward the patient's feet, when the zonula breaks below, the lens will be seen to start, the wound will gap widely and the lens will come out lower side first.

The pressure toward the patient's feet must be kept up gently and slowly till the lens has passed the equator, when the pull downward is changed to a slight push upward, thus tucking the cornea under the lens as in Figure 40.

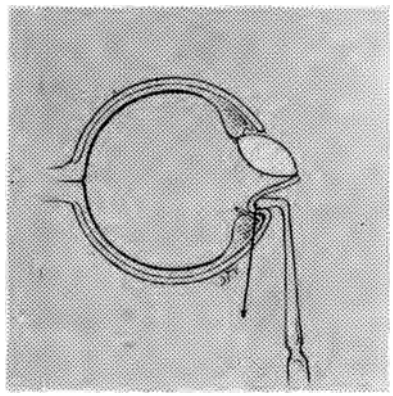

Fig. 39. First Step in Delivery of Tumblers (Vail).

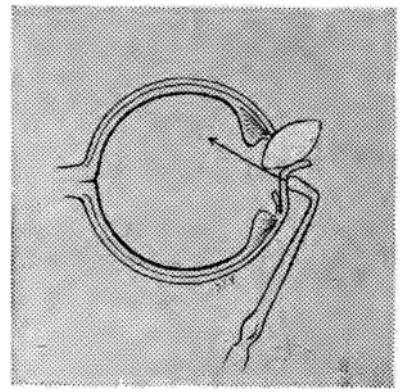

Fig. 40. Second Step in Delivery of Tumblers (Vail).

Fig. 40. Second step in Delivery of Tumblers. A continuation of Fig. 39. The lens has passed the equator and the pressure is being made upward to tuck the cornea in behind it. When a lens has started to tumble a loss of vitreous is rare, if the right kind of pressure and enough be continued to keep the opening full of lens.

If the capsule should break in the case of a tumbler it can usually be extracted with the dissecting forceps as in Figure 36, because the zonula has broken below and the capsule will be hanging outside of the corneal wound.

WHEN SHOULD A CATARACT OPERATION BE PERFORMED: In the intracapsular operation the lens can be removed as soon as the patient is unable to attend to his duties. The lens can be as easily removed at this time as any other and he will be in better condition at this time than later.

PRELIMINARY IRIDECTOMY: The foregoing is a comprehensive description of the intracapsular operation for cataract originated by Col. Smith with the author's modification of it in which the entire operative procedure is performed at one sitting. In the hands of the less experienced operators, however, and indeed often in those of more experience, better results are to be expected if the extraction proper is preceded by a preliminary iridectomy: the cataract operation being performed ten days thereafter.

ADVANTAGES: If a preliminary iridectomy is done the cataract operation is divided into two parts, the iridectomy and the lens delivery. If the iridectomy is made at the time of the extraction the corneal wound is large and any pain caused by pulling the iris out and cutting it might result in the patient squeezing his eye, causing a loss of vitreous or the expulsion of the lens, while, if a preliminary iridectomy is made the corneal

wound is so small that such an accident could hardly occur at that time. For those who do not operate frequently a preliminary iridectomy is recommended with removal of the lens ten days later.

DISADVANTAGES: If a preliminary iridectomy is made and the lens delivered ten days later the patient is subjected to two operations and delay. Some operators of large experience do not make a preliminary iridectomy, because they do not believe that the patient is subjected to greater danger by making the iridectomy at the time of extraction, thus saving the patient two weeks' time and one less operation. The author believes that better results would be obtained by operators who do not operate often if a preliminary iridectomy were made.

METHOD OF OPERATING: A preliminary iridectomy is not made in the same manner as an iridectomy when made at the time of lens delivery, and a speculum can be used because the opening in the cornea is so small that no danger is likely to come from its use.

The eye is cocainized and prepared with as much care as would be taken if a cataract operation were to be performed (see page 35). The operator standing behind the patient's head fixes the eye with fixation forceps in his left hand in the same manner as is done when the incision for a cataract operation is performed. A keratome held in the right hand is passed into the anterior chamber entering it at the sclero-corneal junction or just a little back of it (Figure 41).

Fig. 41. Keratotomy for Preliminary Iridectomy.
Fig. 42. Cutting Off the Iris.

When the keratome is withdrawn the iris may follow it. If this occurs it is picked up with the iris forceps, pulled out, and cut off, but, if it does not follow the withdrawal of the keratome, the iris forceps without teeth can be made to force the iris out as is represented in Figure 15, or the forceps with teeth may be passed into the anterior chamber to grasp the iris at the pupillary edge, pull it out and cut it off (Figure 42).

An assistant should always fix the eye while the iris is being withdrawn

and cut, because the patient might suddenly look up or down causing a serious tear in it. After the iris is cut the edges should be replaced with the iris replacer in the same manner as in Figure 24 and the eye bandaged with the same care as in a cataract operation. The operated eye is bandaged and the dressing not removed for three days, at which time the bandage may be omitted when a result such as is shown in Figure 43 will be found.

Fig. 43. Completed Preliminary Iridectomy.

When the incision is made for extraction two weeks after a preliminary iridectomy the section is made entirely in the cornea, bringing the knife out about two millimeters below the incision made by the keratome. Unnecessary dressing after a preliminary iridectomy is quite as objectionable as too early dressing after a cataract operation, and if the operation is performed under strict aseptic precautions, infection will be practically nil and all that is necessary is to give the corneal wound a chance to heal.

LATE COMPLICATIONS: In addition to the after cataract often following the capsulotomy method of extraction and occurring sometimes when the capsule has been ruptured where an intracapsular extraction has been attempted, the treatment for which is discission; two other late complications sometimes occur, namely, a drawn up pupil and glaucoma. In the author's experience these were of more frequent occurrence while practicing the capsulotomy method than they have been since his adoption of extraction in capsule.

TREATMENT OF DRAWN UP PUPIL: Many methods of treatment of this condition have been described, but the one originated by Col. Smith, the technique of which is as follows, is one of the best: With the eye anesthetized and held open with lid retractors the same as if a cataract operation were to be performed (see page 35)—this last is a very important point since the cornea is to be freely incised when pressure might result in dangerous loss of vitreous—the eye is flushed as for a cataract operation and a transverse incision is made by means of a thin Græfe knife at the level where it is desired to have the lower margin of the pupil. (See Figure 44.)

An assistant now fixes the eye and the operator enters the anterior chamber with iris forceps, catches the iris at the lower pupillary margin with any remaining capsule, draws it gently through the corneal wound,

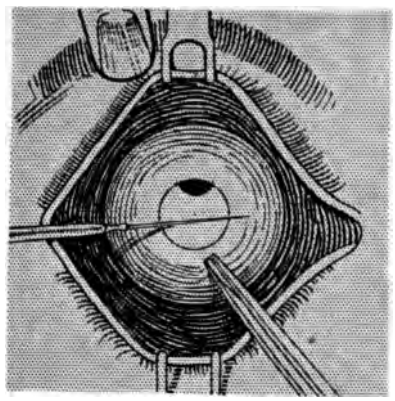

Fig. 44. Keratotomy for Drawn-Up Pupil.

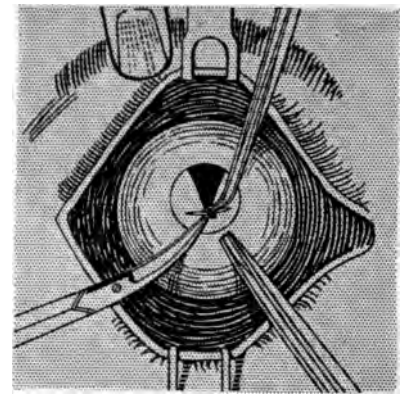

Fig. 45. Cutting off the iris in Drawn-Up Pupil.

and cuts it off with one snip with iris scissors, when the condition illustrated in Figure 46 will result.

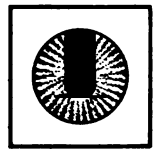

Fig. 46. Properly Restored Pupil.

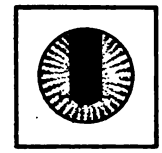

Fig. 47. Improperly Restored Pupil.

The toilet is now made, one per cent atropin ointment instilled and the patient told to close the eyes gently, when the retractors are removed and the operated eye covered with yellow oxide ointment, a large dressing applied, secured with a reinforced starch bandage, taking care during its application to avoid pressure and remembering to cut and adjust it when dry.

At the end of two days the dressing may be removed for inspection of the lids only, but it should be immediately replaced for three days more, during which time it may be conveniently and safely retained in position by means of the protector cut from the original reinforced bandage as previously described (page 45).

Two precautions must be observed in picking up and cutting off the iris: It must be caught at the margin for fear of button-holing and must not be drawn too far through the corneal incision, or the lower margin of the restored pupil will be below the resultant corneal scar as in Figure 47.

GLAUCOMA AFTER CATARACT OPERATIONS is too frequent and often comes on without any warning. The report of a case will be interesting: Mr. L. The left lens was removed in its capsule without complication, July 1, 1915, and he left the hospital July 21 with vision 20/20. He called occasionally since that time more to report his good result than otherwise.

He continued to read fine print till Nov. 2, 1916, "fifteen months," when he was led into my office, stating that his vision had been getting dim for about two weeks. I was astonished to find that he could see only my hand in front of him. Sinuses, tonsils and teeth were negative.

He did not have any pain and only complained of sudden dimness of sight. The tension was 55. The cornea was tapped, eserine and pilocarpine were instilled every three hours, day and night, and large doses of sodium salicylate were given. He made a wonderful improvement and on Nov. 15 his vision was 20/30 with tension 48. On Nov. 16 vision was reduced to 20/40, tension 48. A Smith iridectomy was then performed and he was discharged from the hospital Nov. 26 with 20/30 and tension 28.

The Smith iridectomy for glaucoma should be emphasized and a description of it is as follows:

The small iridectomy which is made prior to or at the time of the extraction does not seem to be a prophylactic against glaucoma. It may be because it is not made deep enough and one must not hesitate to make a deep iridectomy in a case of glaucoma occurring after a cataract operation if the tension persists after repeated paracentesis and the application of eserine and pilocarpine in suitable doses every three hours.

SMITH IRIDECTOMY FOR GLAUCOMA (Drawings by Vail): The technique of the Smith iridectomy is as follows: The eye is anesthetized by instilling a few drops of a 4 per cent solution of cocain two minutes apart for three instillations, followed by the subconjunctival injection of a few drops of 1 per cent cocain above the cornea and below, two minutes after which the speculum is introduced, the conjunctival sac is flushed with two or three ounces of a warm solution of 1-2000 bichloride of mercury from an irrigator suspended two feet above the patient's eye and the solution remaining in the conjunctival sac is taken up with a medicine dropper.

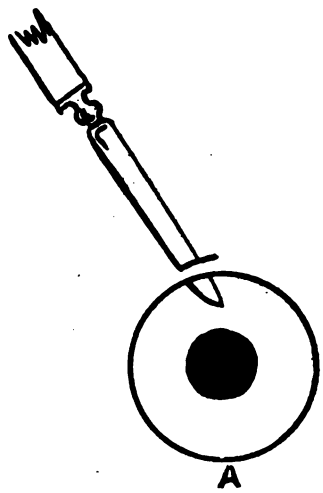

Fig. 48. First Position.

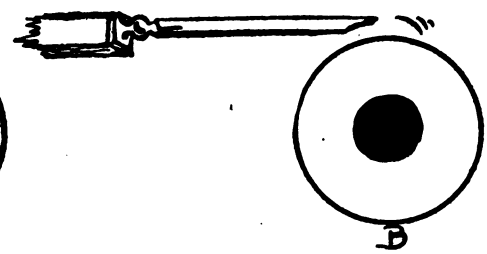

Fig. 49. Second Step in Smith Iridectomy.

The eye is grasped with fixation forceps without a catch as near the cornea as possible and held while the operation is being performed.

A thin cataract knife is made to enter the anterior chamber from 2 mm. back of the sclero-corneal junction until the point can be seen in the anterior chamber. (Figure 49.)

As soon as the point of the knife is seen in the anterior chamber, the handle is depressed and the knife is passed across in the anterior chamber when it is pushed up into the iritic angle. The point of the knife must not be engaged since, if it were, it could not be pulled up into the iritic angle.

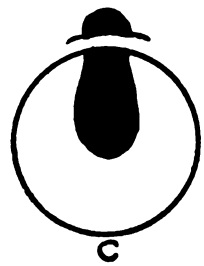

Fig. 50. Third Step in Smith Iridectomy.

The knife is pulled up into the iritic angle as far as it will go and then the edge of the blade is turned up toward the ceiling, when it is made to cut its way out, not by a sawing motion, but by pulling the knife straight up. The knife comes out suddenly and the iris is usually forced out by the sudden evacuation of the anterior chamber (Figure 50). The iris is grasped with iris forceps, drawn out and cut close (Figures 51 and 52) with two or, preferably, three snips with the scissors.

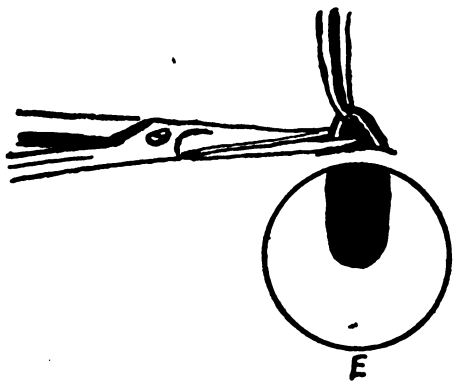

Fig. 51. Beginning Iris Excision.

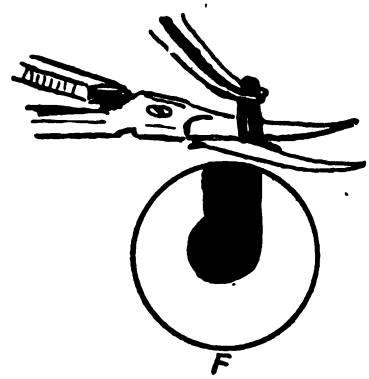

Fig. 52. Completing Iris Excision.

If the iris is not forced out when the incision is made, it can be caught with iris forceps, pulled out and cut close. It is desirable that the eyeball be held with fixation forceps by an assistant while the iridectomy is being made, because, if the eye moves suddenly while the iris is being cut, there would be danger of tearing it.

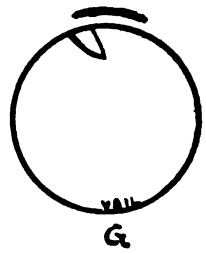

Fig. 53. The Result.

The iris replacer (Figure 54) is passed into the wound and the edges of the iris are tucked into each angle of the cut with the result shown above.

Fig. 54. Iris Replacer.

The eye is covered with 1 per cent yellow oxide of mercury ointment squeezed out of a tube and bandaged. It is dressed daily after the second day and eserine is dropped into the eye every three hours provided the tension is not reduced.

CORNEAL TREPHINING: When glaucoma or plus tension cannot be reduced by medical treatment and a Smith iridectomy has failed to relieve, trephining of the cornea is recommended as a last resort. Some operators trephine when medical treatment has failed, but so many eyes have been reported lost after trephining from some infection of the conjunctiva long after the patient has been discharged; that many operators, including the author, resort to trephining only when all other means have been exhausted.

The experience of the author justifies the statement that the use of the trephine will seldom be necessary after a good iridectomy. However, as a last resort, trephining may be required and is performed as follows:

The eye is prepared and anesthetized in the same manner as would be done in the Smith iridectomy. The speculum is introduced and an incision made in the conjunctiva (see Figure 55).

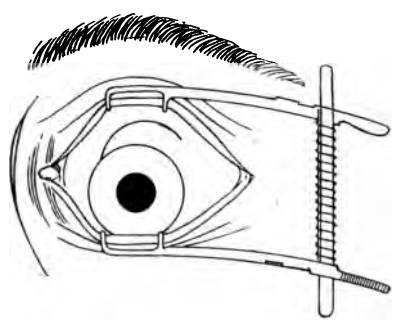

Fig. 55. Conjunctival Incision for Trephining.

The conjunctiva is dissected from above down to the cornea as far as possible, being careful not to make an opening in the conjunctiva over the place selected for the trephine. (See Figure 56.)

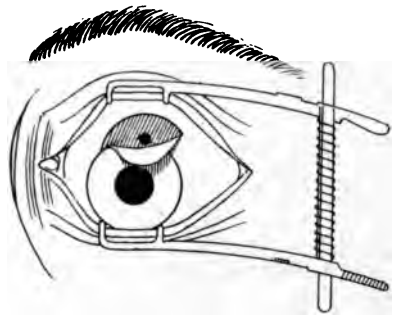

Fig. 56. Conjunctival Dissection for Trephining.

The back of the knife is used for dissecting the conjunctiva when near the cornea. If an opening is made, another spot can be selected for the trephine, because the conjunctiva must be entire over the opening made by the trephine.

The conjunctiva should not be held by forceps while making the dissection, because it is easily torn. When the dissection of the conjunctiva is finished and it is lying upon the cornea, all is ready for the trephine (Fig. 57).

Fig. 57. Gradle Trephine.

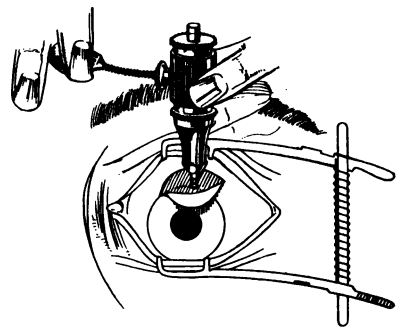

Fig. 58. Trephine in Position.

The trephine is placed vertically upon the sclero-cornea and an opening made by rotating it (Figure 58). When it has passed through, the plug is removed by mouse-tooth forceps and a piece of iris is pulled through the opening with iris forceps and cut off. The operation is now completed by replacing the conjunctiva and bandaging the eye. It is not necessary to place any stitches in the conjunctiva. (Figure 59.)

When the trephine operation is finished (Figure 59) the interior of the eyeball is protected only by a covering of conjunctiva. The opening made by the trephine is supposed to be permanent, but the eye is in danger

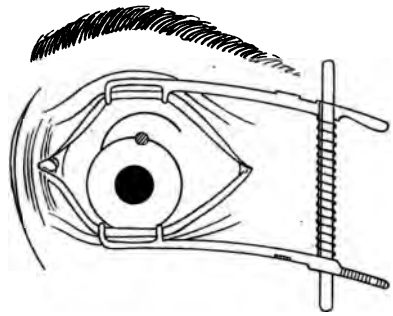

Fig. 59. Operation Finished.

of being infected any time from conjunctival infection. This objection is so serious that many operators, including the author, make use of the operation only as a last resort.

HOW CAN PROFICIENCY IN CATARACT OPERATIONS BE DEVELOPED: It is claimed by some that a cataract operation is the acme of all surgical procedures; certainly few others call for as exact technique or are so pregnant for good or ill to the patient.

So much is at stake in each and every operation that no one should attempt the procedure without having developed a perfect self-confidence and having perfectly mastered the technique.

It is impossible for most oculists to secure this experience on human eyes during a long lifetime, even if consideration for the patient were not taken into account.

It is possible, however, for any operator to so ground himself in the above technique that he may come to his first patient with that necessary perfect self-confidence without having subjected a single human being to the dangers incident to operation by a novice.

It is not necessary for him to spend months or even years in post-graduate schools and clinics, the procedure usually described as necessary to attain this proficiency, but it may be developed at home without loss of time or expense in his own office and practice.

LID HOOKS: The technique of the lid hooks may be learned upon patients in whom local anesthesia has been induced for other purposes, providing enough time is devoted to it. Indeed, any operator can master the technique of the lid hooks and will find them preferable to specula in injuries and in many operations upon the eyeball.

The acquisition of skill in the operation itself is quite another matter, as proficiency in cataract extraction or in any other operation comes only

from practice. In schools for post-graduate instruction there is never complaint of lack of operative material for nose and throat students, but, eyes being precious, there has always been complaint of the amount of eye operations students may be permitted to do.

Our text-books, too, while beautifully describing the various operations that are performed on the eye, have been uniformly silent on the matter of the student making himself capable of performing these operations.

The field offered by the eyes of the lower animals seems to have been almost entirely overlooked since only one small volume, which is now out of print* has appeared on the subject and reference to which is made in only one of over thirty modern texts, none of which, save the one mentioned, even refer to the subject.

THE INCISION: IRIDECTOMY AND LENS DELIVERY: The incision, the iridectomy, the actual lens extraction with or without the use of the needle or spoon—and all the complications may be mastered by practice upon the eyes of kittens, which, after prolonged experiment, have been found to more nearly approximate the conditions of the human than any other available, selecting animals of about four weeks of age and having a cornea about twelve millimeters in diameter.

The following article, read by the author before the Academy of Ophthalmology and Oto-Laryngology at Memphis, Tenn., December, 1916, and published in Annals of Ophthalmology, January, 1917, fully describes a practical method of obtaining ophthalmic surgical technique:

THE USE OF EYES OF KITTENS IN OPHTALMIC OPERATIVE TEACHING

Teaching institutions do not encounter any great difficulty in the instruction of nose and throat operative technique, sufficient clinical material always being available and the procedures usually being of such nature as to make it possible for a novice to undertake them under the direction of a capable assistant after sufficient preliminary reading and instruction. Such, however, has not been the case in the matter of ophthalmic operative teaching. To begin with, there is not a great deal of ophthalmic surgery to be done and the majority of the procedures are so pregnant with such grave possibilities as to preclude their being entrusted to one who has not had experience.

Clearly this experience must be gained on the eyes of the lower animals, but up to the present time no great amount of useful work has been reported in this field. Sheep's eyes have been used for practice in muscle operations, and those of the pig for operations upon the eyeball; but neither are satisfactory. In the sheep the capsule of Tenon is so poorly differentiated and

*Veasey's Ophthalmic Operations as applied to Animal's Eyes.

so many accessory tendonous attachments are encountered as to make the work atypical. As obtained commercially, pig's eyes are delivered enucleated; thus precluding practice upon muscles, and since they have such a large and thick cornea, are quite impractical for corneal work. The iris, too, is so thick that operations upon it are likewise very unsatisfactory.

Dissatisfaction with the use of the above and realization of the need of something better—the use of an eye more nearly approaching the condition obtaining in the human—has induced me to conduct a series of experiments in an effort to find a more satisfactory substitute. Since the greater portion of ophthalmic surgery is concerned with the cornea or iris, alone or combined, my efforts have been directed to finding material in which these structures are analogous to those of the human and have included practically every available small or domestic animal.

The eyes of guinea pigs were rejected because of the small size of the cornea, even in well-grown specimens. Those of the rabbit are nearly like that of the human in point of texture, but the anterior chamber is so shallow that it is quite impossible to make the incision for iridectomies or cataract operations. The eyes of domestic fowls were rejected because of the cartilaginous character of the limbus which effectually prevents proper puncture and counter-puncture and makes it impossible to express the lens by means of pressure.

For muscle work the eyes of the dog were found far superior to those of the sheep because of the well-marked Tenon's capsule and the character of the tendons which are the same as in the human eye. It is necessary, however, to select the eyes of well-grown animals to find muscles of a size comparable to those in the human subject. This, as in the sheep, results in the selection of material in which the cornea is too large and dense for satisfactory work upon the globe.

For work upon the eyeball proper, the eyes of kittens were found so far superior for all purposes to all the others mentioned that, once used, they will never be discarded. The reason for this lies in the fact that while, as in other lower animals, the ratio of diameter of cornea to size of the eye is greater than in the human, by proper selection, specimens may be readily obtained in which the size and thickness of cornea, depth of anterior chamber and texture of iris—the important points of this work—are analogous in every respect to those of the human eye. To meet these conditions, one should use the eyes of kittens from four to five weeks old and weighing about twenty-four ounces.

The question of the availability of material is not at all pertinent because no difficulty need be experienced, even in our larger cities, in procuring it regularly in quantity and at really very small expense.

TECHNIQUE: The following has been found to be a good working plan: The kittens should be killed before beginning work after having been dusted lightly with powdered naphthalene to dispose of any vermin present

The killing may be most conveniently and cheaply done by the injection of one-half grain of strychnine sulphate intra-pleurally. Cut away the lids and nictitating membrane, which interfere and the absence of which does not impair the work in the least. Then do tenotomies on the recti muscles and finally, since the eye, because of its deep-set position, must be removed and placed in a mask for cataract work; enucleate by any of the methods advised.

The eye should now be fixed in a suitable mask, which can be easily improvised from a deep cigar box. (Figure 60.) The bottom of the cigar box being too thin, the lid is removed and fastened securely to the bottom by means of glue or nails. Locate two points on the reinforced bottom three-fourths inch from either side and one and one-half inch from one end. At these points burn holes with an ordinary hot poker not to exceed one-quarter inch in diameter and cautiously enlarge them to one-half inch, taking care not to burn too deeply into the wood.

Fig. 60. Cigar Box Mask.

Strive to make a concavity in which to have the eye rest snugly and at the same time have enough of the bottom of the box behind it to prevent its drawing through when fixed in position. Drill two more holes large enough to accommodate any small wooden cylindrical rod—a lead pencil does nicely —near the free edges and opposite those in the bottom of the box. Slot one of the holes and make a key to fit the slot snugly that when pressed home it will prevent the pencil's turning. Flatten one or two sides of the pencil and the mask is ready for use as follows:

Pass a strong, sufficiently long thread into the scleral tissue near the optic nerve and drop the ends through one of the bottom holes, either right or left, as may be desired. Make one or two overlapping retaining turns over the flattened pencil and then continue turning until the eye is drawn snugly into the cup made for it at just the proper tension as determined by the tonometer.

A new mask (Figure 61) I have devised for this special work, with which the eye is similarly secured and maintained at the proper tension

with less trouble in passing the thread as described with the mask made from the cigar box, has some advantages.

With the eye thus fixed, the regular cataract procedure may be taken up in order, viz.: Incision, iridectomy, by any of the described methods; capsulotomy with cystitome or capsule forceps if practice in the classical

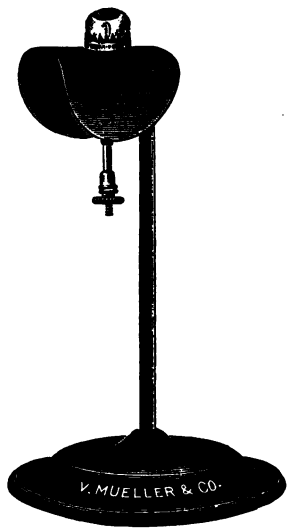

Fig. 61. Improved Mask in Use.

method of extraction is desired; lens extraction in capsule and, finally, replacement of the iris and toilet of the corneal wound.

We must admit that experience is our greatest teacher in this operation, but that material is practically unavailable. Eyes are too precious for teachers to allow students to operate, hence, the only chance one has to acquire experience in this delicate surgery is to witness operations.

If a student could have an opportunity to operate for cataract upon one hundred eyes and this experience could be obtained in a short time, he could acquire quite a good technique; but, this experience extending over many years, as is usually the case, by the time one has acquired a reasonably safe technique he is loth to change or take up another method. If, then, one will operate upon a sufficient number of kittens' eyes to get a technique, he can remove lenses in capsule quite as well as by the old method. A trial of the method will convince anyone of its efficacy.

There are probably few operators who would not accept the intracapsular operation providing they could have enough experience to master that technique. A good incision is imperative whatever method is selected for a cataract operation and this can be mastered providing enough material is used. In addition to the above, all of the operations upon the eyeball that are described in the text-books may be performed on these eyes precisely as

they would be in the human subject with or without preliminary enucleation as the student may elect.

The reason that ophthalmic surgery is generally considered difficult lies in the fact that all save our most experienced operators approach a given case with a feeling of unpreparedness and uncertainty resulting from a lack of the co-ordination of brain and hand that can come only from operating many times.

With the material described, however, this need not be the case, for in a comparatively short time, which is a distinct advantage in acquiring technique, any student can with, say, one hundred kittens do as much operative work as the busiest oculist in many years. One hundred kittens (two hundred eyes) will furnish material for four hundred muscle operations, two hundred enucleations, two hundred iridectomies and two hundred cataract extractions, making, in all, one thousand operations. If the student uses this or twice this amount of material he cannot fail to bring to his operating room an experience and confidence that can be secured in no other way.

WHEN AND HOW SHOULD A CATARCT OPERATION BE PERFORMED: The majority of the world's ophthalmic surgeons would say to the patient, "Wait till you are blind or the cataract is mature and have the operation"—that is practiced by most ophthalmic surgeons.

It is a serious matter to advise a patient with immature cataract to delay the operation when his adviser knows this advice would not be given if he had material enough to master the intracapsular technique. Smith of India states that when the lens becomes so opaque that vision is no longer useful for ordinary practical purposes, it should be extracted in capsule.

Ophthalmic surgeons the world over would give the same opinion if they could remove lenses as Smith does and the only excuse is the want of material to operate upon.

Removing a lens by any method is a delicate procedure and requires much experience to become proficient. Whichever method the operator received his experience in is the one he is familiar with and when he has operated about fifty or more times he is loth to change from the method he feels that he has mastered.

Cataract operations by any method performed by fair operators upon patients commonly called good are usually successful and those that are failures would usually have been successful providing no accident or complication had occurred. Accidents and complications must then be emphasized more than the method of operating, and the method of operating should be selected that will give the best general visual results and the complications common to this method emphasized.

If the lens is successfully removed in capsule, inflammation is rare and it is not necessary to make a secondary operation upon the capsule. If this method can be successfully mastered, these advantages, together with the

fact that the operation can be performed at any stage of opacity, is surely worth consideration.

The greatest objection to the intracapsular cataract operation seems to be the fear of loss of vitreous. This complication is recognized as serious when operating by any method, but when it occurs before the lens is delivered it is more serious because the lens must be delivered and this cannot be accomplished by pressure upon the cornea and if the lens is delivered with a wire loop passed into the vitreous, the complication is very grave. This accident must be emphasized and, if possible, a method of taking care of it devised.

HOW TO AVOID COMPLICATIONS: The operator should familiarize himself with the hooks, not upon cataract patients, but upon anyone with the eye anesthetized by holocain. If the lids are mastered in this manner by the operator, he will have little trouble in instructing an assistant or nurse. The one thing necessary for proficiency is enough practice upon human eyes.

When operating by any method the lids must be held away from the

Fig. 62. Author's Upper Lid Hook.

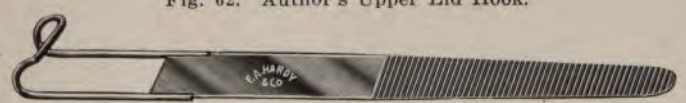

Fig. 63. Author's Lower Lid Hook.

Fig. 64. Lid Hook in Position.

Fig. 65. Threatened Danger.

Fig. 64. Author's double lid hook, holding the upper lid away from the eye, keeping all pressure from the globe, the assistant's fingers resting upon the patient's nose. The thumb of left hand holding the lower lid down, a second assistant or nurse holding the brow up. The assistant holding the lid hooks stands at the left side of the patient when operating upon either eye.

Fig. 65. The same as No. 64, except the double hook is pulling the lid forward or down to take off all pressure in impending or actual loss of vitreous, the double hook being depressed to keep from slipping out from under the lid.

eyeball and this is best done by the lid hooks I have devised (Figures 62 and 63), in the manner described in Figures 64 and 65, or those devised by Dr. Derrick T. Vail.

LOSS OF VITREOUS PRECEDING LENS DELIVERY: This complication is a serious one unless handled in a proper manner. Figure 66 represents Smith's method of removing the lens when the intracapsular operation is being performed and a loss of vitreous is imminent or has actually occurred.

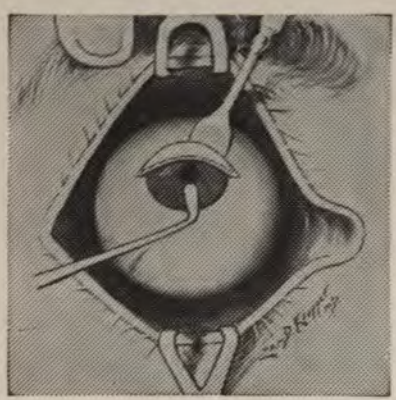

Fig. 66. Use of Smith Spoon.

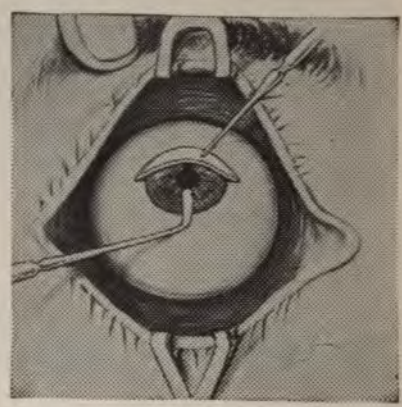

Fig. 67. Use of Author's Needle.

Fig. 66. Smith's Method with Author's Modification of Operating When Vitreous Precedes Lens Delivery: If loss of vitreous preceding lens delivery has occurred in the intracapsular operation, the lens is delivered by the Smith method with the lids held away from the globe by author's retractors, the same as in the beginning of the operation. Pressure of the hook is removed, the Smith spoon is passed down behind the lens and pressure is then made to cause it to slide up the spoon and out.

Fig. 67. Author's Method of Operating When Vitreous Precedes Lens Delivery: Loss of vitreous preceding lens delivery has occurred in the intracapsular operation, the lids are being held away from the globe by author's lid hooks, the same as when the operation began. The author's needle which was held in the left hand waiting for such an accident, is stuck into the edge of the lens, and, with just a little pull upward, together with slight pressure upon the cornea with the hook, the lens either comes out in capsule or the capsule ruptures.

Fig. 68. Smith-Fisher Instrument.

Delivery of the lens by the intracapsular method cannot be successfully demonstrated upon kittens' eyes, because the animal is too young, but experience can be obtained in the use of the Smith spoon and the author's needle. If this method is emphasized and plenty of kittens sacrificed, the complication that seems to keep the intracapsular operation from being accepted will not be as serious as it now appears. Many operators have attempted the intracapsular operation without this experience and have failed.

The technique of the cataract operation as described will spell success no matter what method is selected. It seems strange that many operators of large experience advise mastering the capsulotomy method and operating not less than one hundred times before taking up the intracapsular operation when emphasis should be given the complications of cataract operations by any method.

HOW TO PROCEED TO DELIVER A LENS: When an operator can make a good incision upon the kitten's eyes, has mastered the lid hooks upon human eyes, Smith spoon and author's needle upon kittens' eyes, he begins the operation by making as good an incision as he can, makes the best iridectomy he can, and instead of cutting the capsule he proceeds to remove the lens by the intracapsular method, holding the needle in position as described in Figure 67, ready to stick into the lens if it refuses to be born after he has made pressure he considers safe, or if vitreous loss seems imminent, or, if it has actually escaped. The spoon being reserved for any case when the lens slips back into the eye, preventing the use of the needle. The more expert the operator, the less use he will have for the spoon or needle.

Some capsules will rupture when the needle is used, but most operators would prefer a secondary needling to a loss of vitreous.

AFTER TREATMENT OF CATARACT: If the lens is removed in its capsule inflammation is rare and the daily treatment recommended after the capsulotomy method is omitted. The bandage can be changed the fourth day and a new one applied, but the lids should not be opened and this bandage should not be disturbed for five days more, unless the patient complains. Nine days after the operation the corneal wound is usually closed, the anterior chamber reformed, the bandage is omitted and the patient is given smoked glasses. If a prolapse of the iris is found at the first inspection nine days after the operation, the eye is rebandaged for four more days, at which time the prolapse iris is cut off. After a cataract operation the patient should be put to bed and kept there twenty-four hours, after which he can be up and down as is most comfortable, advising him that the bed is the best place for the first week. Daily inspection of the eyes is unnecessary and often harmful.

CONCLUSIONS: 1. Master the lid hooks and teach an assistant by practice upon human eyes, and the incision, Smith spoon and author's needle upon kittens' eyes before beginning a cataract operation by any method.

2. Students cannot become competent to do surgical operations upon the eye by watching others.

3. The eyes of four weeks old kittens are better for teaching ophthalmic surgery than are those of other animals.

4. Any student who has prepared himself for ophthalmology can get an operative technique in this manner not equalled by any other.

WHO SHOULD DO CATARACT OPERATIONS: There is a more or less widespread idea among oculists that the number of cataract operators should be limited, that only a chosen fortunate few are capable of developing the requisite skill. A little thought, however, will demonstrate that of the operators whose work is compared, all other things being equal, the one who has had greater experience will do the better operation and have better results. In this, as in everything else, skill comes from practice, and the method which has been described is the best as yet devised for the securing of that practice; offering as it does no loss of time, and frequent enough application to train the muscles used and to insure a profiting by previous errors. Any operator who will faithfully follow the above procedure with as many kittens' eyes as may be required to make him proficient can and will learn to successfully perform the intracapsular operation.

In emphasizing the intracapsular operation, the author is cognizant of the many dangers that may occur at the time of operation, and the complications that may follow whether the lens is removed in or out of capsule. He has operated long enough by the capsulotomy method to know there are many dangers at the time of operation and after, and he has removed a sufficient number of lenses in capsule to be in a position to judge of the advantages and disadvantages of each method.

With this experience and knowing what can be accomplished with the aid of four weeks old kittens the author has no hesitation in recommending the technique he has described to beginners as well as finished operators, but not unless they will become proficient:

FIRST: In the use of the lid hooks by practice upon anesthetized human eyes, not while operating for cataract, but upon human eyes anesthetized for practice.

SECOND: Operate upon a sufficient number of kittens' eyes to be able to make a good incision.

THIRD: Master the Smith spoon and author's needle upon kittens' eyes. If the operator decides to operate by the capsulotomy the technique which has been described will result in less complications.

The late Dr. Greene, of Dayton, and Dr. D. T. Vail, of Cincinnati, accurately described the intracapsular operation as was performed by Col. Smith, of India, but there seems to be something that interferes with its general adoption. The author believes that the reproduction of three of his articles will emphasize the modifications he has made.

THE FIRST ARTICLE: Describing the operation as he observed

it in Smith's clinic with the addition of his double upper lid hook intended to make the assistant possible.

THE SECOND ARTICLE: Comparing the capsulotomy and the intracapsular operation and showing the lids held apart by upper and lower lid hooks and the needle in operation to assist in lens delivery.

THE THIRD ARTICLE: Giving the visual results of ninety-four consecutive operations.

THE INTRACAPSULAR CATARACT OPERATION IN IMMATURE CATARACT

Read before the Chicago Ophthalmological Society, February 16, 1914.
Reprinted from Ophthalmology, April, 1914.

Removal of the lens in its capsule is beginning to be considered an ideal cataract operation, and I believe would be practiced and recommended by most ophthalmic surgeons if the lens could be removed in its capsule without incurring more danger to the eye than occurs in any of the other methods. If, then, the extraction as performed by Lieut. Col. Henry Smith, of Amritsar, India, could be practiced without more danger than by other methods, the intracapsular operation would certainly be the one of choice.

There are two serious objections to the intracapsular operation; first, the want of an experienced assistant, and second, the great danger of loss of vitreous. It may seem presumptuous for me to claim that these two objections can be overcome, but I have a plan of eliminating both of them, or, at least robbing them of most of their dangers. The want of a properly trained assistant has always been considered sufficient cause to deter many good operators from attempting the intracapsular operation. I do not underestimate the value of a good assistant, but I think my double lid hook will simplify the assistant's part of the operation, and Col. Smith believes with me that an assistant can be trained with this instrument in a comparatively short time to successfully care for the lids. With the proper assistant some operators might be bold enough to attempt the removal of a lens in its capsule. However, even if a skillful operator with a good assistant attempted the removal of a lens in its capsule before he knew how to introduce the Smith spoon in impending or actual loss of vitreous, he would soon meet with disaster.

It is not a difficult matter after cocainization of the patient or a number of them to become familiar with the lid hook, not only holding the lid away from the eye when expelling the lens, but also during the incision and the iridectomy. There are only two positions in which the lid should be held and they should be thoroughly mastered by both operator and assistant, before beginning so important an operation as the removal of the lens by any method.

Holding the lid in a proper manner with the lid hook is not so simple as it appears, but the technic can be quickly mastered on any patient after the instillation of cocain. It may seem so simple that some good operators might operate upon a cataract to try it out, but this would be unfair to the patient. One should go through several mock operations before operating upon a patient.

Technic of the Lid Hook

To operate upon the right eye the assistant stands on the left side of the patient, introducing the lid elevator under the upper lid, holding it up with his right hand, his fingers resting upon the patient's nose and the lower lid is kept down with his left thumb. No. 1—When operating on the right eye the operator stands behind the patient during the incision and the iridectomy and to the right side and in front of him while extracting the lens. When the incision has been finished and the iridectomy performed, the assistant removes the lid retractor and introduces the double hook. In this position of the lid the operation is finished and the lid closed before removing the instrument, a second assistant or nurse being necessary to hold the eyebrow up during the operation and another to fix the eyeball while making the iridectomy. When operating on the left eye the surgeon makes the incision with his left hand, and the assistant keeps the same position as in operating upon the right eye, but if he makes the incision upon the left eye with his right hand, standing on the left side and in front of the patient, the assistant should stand upon the right side of the patient, holding the lid up with the lid elevator in his left hand and keeping the lid down with the thumb of his right hand. When the incision is finished the assistant removes the lid elevator, stands upon the left side of the patient, introduces the double hook when the iridectomy is made and the operation finished, with the assistant's fingers resting upon the side of the face, instead of nose, and the same position assumed as when operating upon the right eye. The operator stands upon the right side of the patient in delivering the lens in either eye. There are two positions for the double

Fig. 1.

Fig. 2.

Fig. 1. Author's double lid hook, holding the upper lid away from the eye, keeping all pressure from the globe, the assistant's fingers resting upon the patient's nose. The thumb of left hand holding the lower lid down, a second assistant holding the brow up.

Fig. 2. The same as No. 1, except the double hook is pulling the lid forward or down to take off all pressure in impeding or actual loss of vitreous, the double hook being depressed to keep from slipping out from under the lid.

hook, one for holding the lid up and away from the eyeball, No. 1, the other, the patient being nervous or an impending danger of loss of vitreous, when the lid should be pulled down toward the patient's feet. No. 2—A little drilling will soon make any physician or nurse a good assistant.

Eye Speculum

There are many eye specula that will hold the lids open in a proper manner when the patient is not nervous or made so by the little pain, but

no one can tell when a patient is going to squeeze his lids and make pressure upon the eyeball. If a surgeon must use an eye speculum to make the incision he should not use one while the lens is being delivered. If specula must be abandoned for the delivery of the lens, I believe they should not be used at all during any part of a cataract operation.

Loss of Vitreous

The Smith spoon is not as easily placed behind the lens with the left hand as some may believe, but it is possible to get this technic by operating upon animals' eyes. After a large experience with the intracapsular operation there was one thing I feared when I left India and that was the introduction of the spoon to deliver the lens in impending or actual loss of vitreous. I operated upon more than 100 eyes before I was permitted to use the spoon and after that my loss of vitreous was not great enough for me to become proficient in the use of the instrument. When I returned to Chicago I made myself familiar with the introduction of the Smith spoon by practice on pigs' eyes placed in a mask. A dog will do quite well, one animal or a few pigs' eyes being sufficient because the spoon can be placed in the eye in position for the removal of the lens often enough to make the operator quite familiar with the technic.

The spoon delivery should be practiced in this manner until the operator has confidence in its application before attempting the removal of a lens by any method from a human eye. The more skillful the operator in delivering the lens, the less often will he be called upon to use the spoon, but he must be prepared to use it at any time. Anyone not having this experience will surely meet with disaster if he waits for the opportunity to use the spoon until he sees the vitreous actually escaping from his patient's eyes. (Figures 3, 6.)

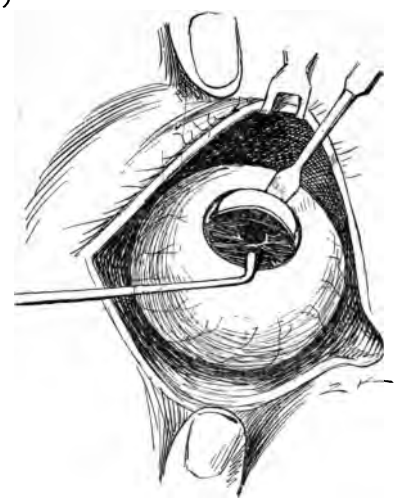

Fig. 3. Author's double lid hook holding the upper lid away from the eyeball, the lower down with the thumb of left hand. A second assistant is holding up the brow. A slight amount of vitreous has escaped pressure of the hook, has been removed and the Smith spoon introduced behind the lens. When the spoon is well in behind the lens pressure is again made upon the cornea with the hook and the lens is expelled, using the spoon as a background to make pressure. In this manner the minimum amount of vitreous will be lost. This technic can be fairly well mastered by practice upon a dog or pig's eyes in a mask. This technic, being so far superior to any other, should be mastered before attempting the removal of the lens by any method.

Prejudice

Let us lay aside all prejudices, if we have any, and approach the intracapsular operation in a receptive mood. The men, as far as I know, who have studied this work in India, are satisfied with it and are doing it. They have told us how Smith does it, but they did not seem to see the difficulties and how to overcome them as they appear to me. Dr. Derrick T. Vail, of Cincinnati, Ohio, reported 350 operations from Smith's clinic and gave us full details, beautiful drawings and accurate description of the different stages of the operation. With his permission I am using several of his drawings: Nos. 6, 7, 8, 9, 10, 11, 12.

The late Dr. Greene, of Dayton, operated upon more than 400 cases in Smith's clinic and he also described the operation minutely, but there seemed to be something about the technic that has kept others from adopting it. I believe the removal of apparently dangerous obstacles will encourage good operators to undertake the operation.

Description of the Operation

No one need go to India to learn how to prepare a patient or the instruments for a cataract operation and I will assume the patient has been given a good dose of bromide two hours before the time for operation, a few

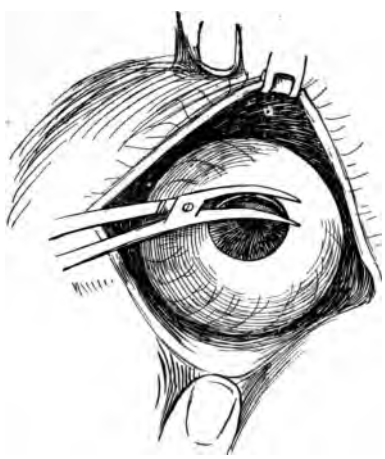

Fig. 4.

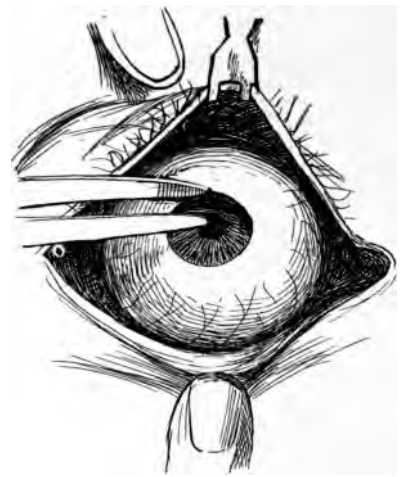

Fig. 5.

Fig. 4. Author's double lid hook holding the upper lid away from the eyeball with the right hand and the lower down with the thumb of left hand, a second assistant holding up the brow. The iris scissors are shown in position to cut off any protruding vitreous.

Fig. 5. Author's double lid hook holding the upper lid away from the eyeball with the right hand, the lower down with thumb of left hand, a second assistant holding the brow up, and a plain dissecting forceps removing the capsule that has burst or any corticle that has been left behind. This is not a difficult matter in a tumbler, because the zonula has burst below and the capsule is hanging from above. If the capsule had burst in the upright delivery the zonula will have been ruptured above and the capsule wound be hanging deep in the eye. Iris forceps must be used to remove the capsule when the capsule has burst in removing the lens in the upright method.

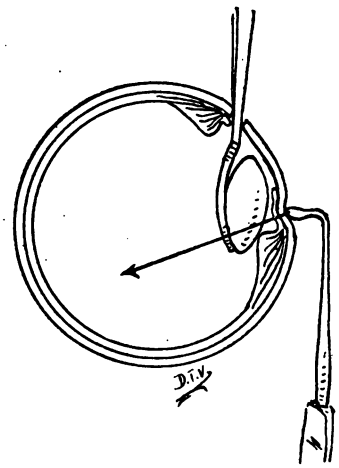

Fig. 6.

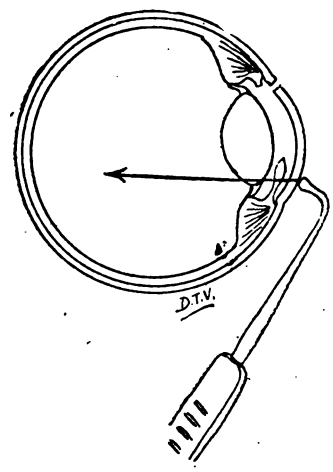

Fig. 7.

Fig. 6. Vail. Shows the Smith spoon inserted behind the lens, which has been introduced after an escape of vitreous. The spoon is held in this position while pressure is being made on the cornea against the spoon, causing the lens to be expelled in front of the spoon. I consider the spoon delivery as devised and practiced by Smith a great step forward in ophthalmic surgery, and if practiced would be the means of saving many eyes that would otherwise be lost. See Fig. 3 for a further description of removing the lens after vitreous has escaped.

Fig. 7. Vail. Shows where the pressure upon the cornea is made in all cases of immature cataract. The pressure is continued toward the optic nerve. In the drawing the pressure is made with the point of the hook. Smith now lays the hook flat upon the cornea and makes pressure in the same manner as is represented in the drawing, No. 14. The direction of the pressure is indicated by the arrow. This change was made to get more pressure on the vitreous, which was formerly made by the spoon held in the left hand. The spoon, now held in the left hand is scarcely ever used except in vitreous loss.

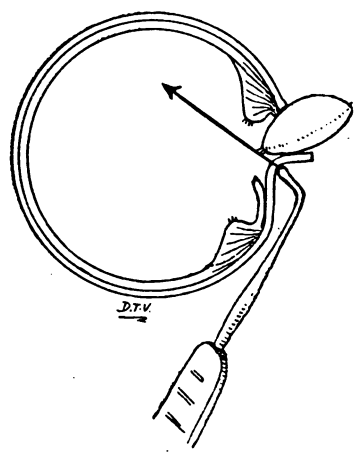

Fig. 8. Vail. The hook is shown pressing with the point in the proper direction, but as in Fig. 14 the hook should be laid flat upon the cornea for the same reason as in Fig. 7. The cornea should be tucked in behind the lens as the lens advances, the pressure being very light, but at no time should the pressure be entirely removed until the lens is hanging in the wound.

drops of a 4 per cent of cocain solution having been instilled three minutes before the operation, the lashes cut from half of the outer side of the upper lid and everything is ready. The knife should be held as one holds a pen and the blade placed at an angle of about 15 degrees from the iris. The puncture and the counter-puncture should be made as deep as can be done with safety, and include half of the cornea. When the counter-puncture is being made the handle of the knife should be lowered and the incision

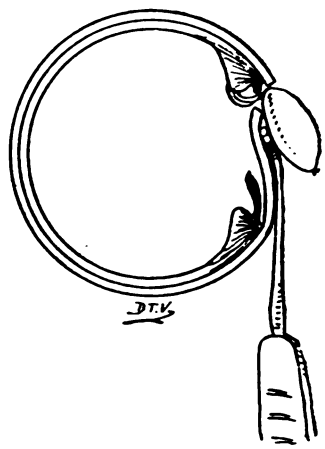

Fig. 9.

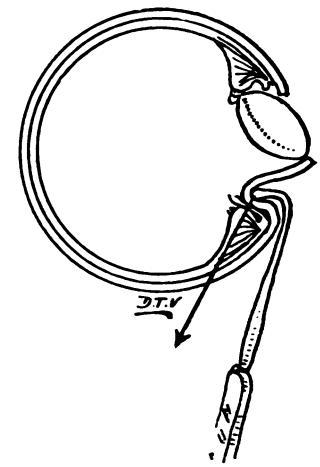

Fig. 10.

Fig. 9. Vail. A continuation of Fig. 8. The cornea is being tucked back under the lens to prevent it from settling back in the eye. The lens is now ready to be delivered by the hook, as in Fig. 16.

Fig. 10. Vail. A lens that is swollen and has soft material can usually be tumbled (see description of the technic of a tumbler). If a lens has the appearance of being a tumbler and you fail in this manipulation, that method can be abandoned and the upright method employed. In this case the hook is placed with the point just below the pupil and the eye pulled down towards the patient's feet, the hook being caught on the ciliary ridge. The pressure is continuous downward, but no deep pressure is made. If the capsule breaks below the lens will turn upside down and come up and out bottom side first, as is shown in Fig. 11. Great care should be exercised at this point. The traction downward should be slow, and as the lens advances the downward traction should be stopped and the cornea tucked up under the lens. (Fig. 12.)

made slowly and if possible, with one sweep of the knife. If you prefer making a conjunctival flap you will probably have some hemorrhage that will obscure your view in the delivery of the lens and this is quite troublesome to one with little experience in extracting in the capsule.

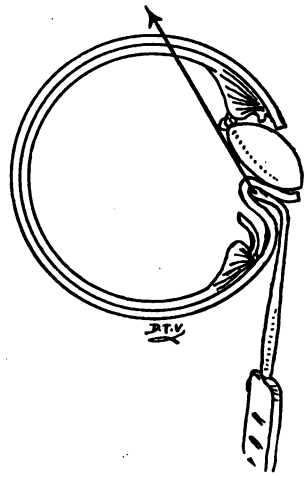

Fig. 11.

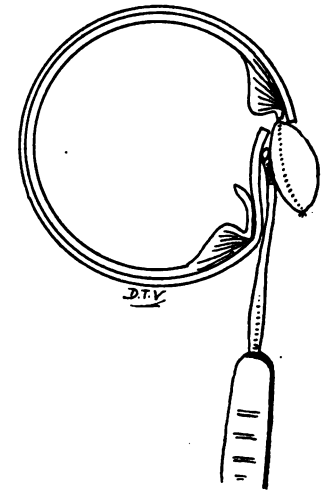

Fig. 12.

Fig. 11. Vail. The second step in a tumbler, first step Fig 10. Downward traction has been removed and the cornea is being tucked in behind the lens.

Fig. 12. Vail. The third step in a tumbler, the second illustrated in Fig 11. The lens is ready for final delivery, as in Fig. 16.

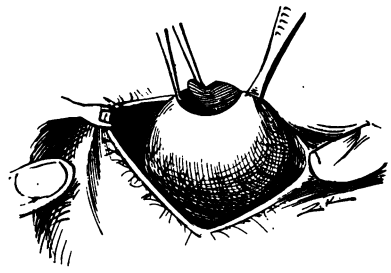

Fig. 13.

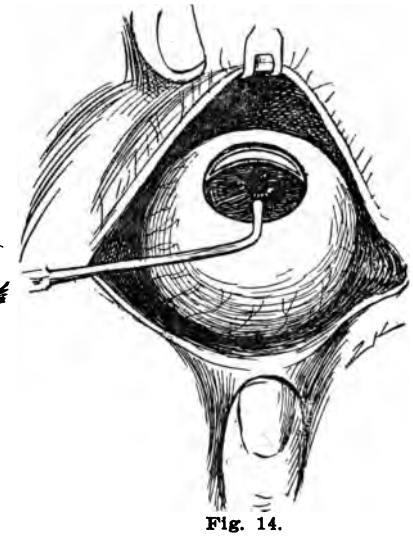

Fig. 14.

Fig. 13. Author's lid elevator holding the upper lid away from the eye with the right hand, the lower down with the thumb of the left hand; a second assistant holding the brow up and another assistant holding the eyeball with fixation forceps. The iris forceps held vertically, as is done by Smith, one blade resting just inside of the upper edge of the corneal wound and the other pushing the iris out of the wound. when it is grasped and cut with the iris forceps.

Fig. 14. Author's double lid hook holding the upper lid away from the eyeball with the right hand, the lower down with thumb of left hand, a second assistant holding brow up. The hook is laid flat upon the cornea and pressure made directly backward towards the optic nerve.

The Iridectomy

The method employed by Smith is not as simple as it appears, but any good operator should be able to do it, with a little experience. No. 13. It is not usually necessary to introduce the iris forceps into the eye, and if the ophthalmic surgeon insists in putting the iris forceps into the eye he may be rewarded by some injured capsule which will prevent the removal of the lens in its capsule.

Preliminary Iridectomy

Some ophthalmic surgeons recommend preliminary iridectomy in certain cases and I have in a previous paper recommended a preliminary iridectomy in all cases. Since my experience in India I feel that a preliminary iridectomy would be of advantage, especially to those who do not operate frequently.

Delivery of the Lens

There are only two methods of delivering the lens: the upright, Nos. 14, 15, 16, and the tumblers. Nos. 10, 11, 12. I will describe the upright first, because all immature cataracts are delivered in this manner. The hook is placed flat upon the cornea, the point being about 3 mm. from the sclero-corneal margin and pressure is made directly down toward the optic nerve. No. 14. Here let me caution you to practice on animals' eyes by holding the hook loose between the fingers as you would hold the knife. One can only learn to be dexterous by holding the instruments loosely in the fingers. The pressure of the hook is made toward the optic nerve and must be taken off as the lens comes through the wound in the cornea. If

Fig. 15.

Fig. 16.

Fig. 15. A continuation of Fig. 14. Author's double lid hook holding the upper lid away from the eyeball with the right hand, the lower down with thumb of left hand. A second assistant is holding the brow up, while the Smith hook is making pressure directly backwards towards the optic nerve. The pressure is kept up until the lens has passed the equator, when the hook is moved upward to keep the corneal wound closed.

Fig. 16. A continuation of Fig. 15. Author's double lid hook holding the upper lid away from the eye while the Smith hook is removing the lens, which is hanging in the wound. The hook is turned up to avoid rupturing the capsule.

the pressure is removed before the lens has passed beyond the equator it may slip back into the eye and if too great pressure is made the capsule may burst or the lens comes out too quick and perhaps some vitreous.

Experience only can teach one how much pressure to make in delivering the lens, but enough must be maintained to keep the corneal wound full of lens, otherwise vitreous will escape. The lens being partially expelled and hanging in the wound is extracted with the hook. No. 16.

Tumblers

Lenses that have soft material may be made to tumble. I can only tell you to try to tumble a lens if you think it has soft material and if you cannot dislocate it below you can abandon this method and use the technic as described for the upright method. The pressure for a tumbler is made with the point of the hook placed about 3 mm. from the sclero-corneal margin. Engaging the point of the hook on the ciliary ridge, the eye is pulled down toward the patient's feet. No. 10. The pressure should be continuous and if the lens tumbles, you will see it turn upside down after the zonula has broken below and as soon as the lens has passed the equator, the hook should be kept close up to the cornea, but loosely, and tuck the cornea in behind the lens. Nos. 11, 12. As soon as the lens is out of the eye, but hanging in the wound, the delivery is finished with the hook. No. 16. If the capsule bursts in a tumbler nothing serious has happened because the capsule has broken loose from below and can usually be removed from the corneal wound with the dressing forceps and any cortical matter can usually be treated in the same manner.

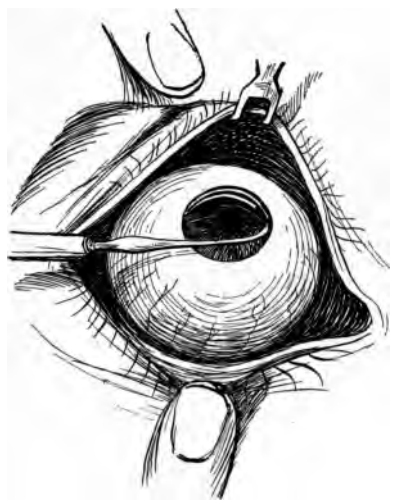

Fig. 17. Author's double lid hook holding the upper lid up with the right hand, the lower down with the thumb of the left hand; a second assistant is holding up the brow. The Smith iris replacer is seen in the corneal wound replacing the iris. It is not necessary to have the patient look down when replacing the iris.

The Toilet

The lid is held up and away from the eye by the double hook. No. 17. The patient usually looks up which position aids replacement of the iris. Should the patient not look up he will do so on request. It is not

necessary, but dangerous to have the patient look down after the incision has been made. The iris is tucked back into the edges of the corneal wound with the Smith spatula, and the eyes closed. Any clean dressing that suits the operator will be proper, but Smith prefers to cover both eyes with a light dressing after the lashes have been covered with yellow oxide of mercury, one grain to the ounce. Whatever dressing is used, no presure should be applied.

After Treatment

No matter what after treatment is followed, the result will usually be good if the operation has been performed without accident. The less after treatment the better. The dressing need not be removed for nine days unless the patient complains and usually he is ready to be discharged at the first dressing. If it is convenient for the patient to call for glasses he can do so in about a month, if not, he should be instructed to go to his nearest oculist in about a month. In Smith's clinic the patient is usually discharged at the first dressing and instructed to go to the nearest oculist in a month. Should the wound be opened or a prolapsed iris at the first dressing, the operated eye should be bandaged for four more days at which time the iris can be better excised than sooner. The eye should not be held by forceps when a prolapsed iris is excised on account of the danger of reopening the wound.

Should An Immature Cataract Be Operated Upon?

If the objections to the removal of the lens in its capsule can be overcome why should a patient with beginning cataract wait for maturity? The history of an ordinary senile cataract might be given as follows: A patient usually in good health about middle life or later consults his family doctor or his ophthalmic surgeon for failing vision. His vision has been failing for an indefinite time and now he is unable to attend to his ordinary duties. The family doctor may not be able to make a diagnosis of beginning cataract, and he is referred to the ophthalmic surgeon who finds an opacity of the lens. His urine is examined and if found negative he is told he has beginning cataract and nothing can be done for him until the cataracts are more mature. He is dismissed with the only instruction to wait developments and is requested to return in a few months. If the patient is loyal to his family doctor and his ophthalmic surgeon he will return as requested and is again told nothing can be done at this time, but that he is getting along quite satisfactorily and as soon as he is blind or nearly blind an operation can be performed. He has not received any income for a long time, he has exhausted his savings and is probably in debt, health not as good as it was when he was active, his spirits and nerve have deserted him. He is operated upon in this condition in a free clinic. If the operation is successful his vision is restored, but he has not been able to attend to his duties for so long a time that a younger man has probably taken his position and his earning capacity is greatly reduced. This same man complaining of the same symptoms could have had his lens removed in the capsule as soon as it was opaque enough to prevent him from attending to his ordinary duties. He would have lost only a few weeks at most. He would have been operated upon when his health and spirits were good. He would have returned to his position before another was substituted and he could have gone on indefinitely as a bread winner for his family. With

such a true history should the ophthalmic surgeon operate upon immature cataract? The question can easily be answered yes, providing his operator can remove the lens in its capsule successfully. I contend that it can and with better results than by waiting for maturity and operating by the old method. In the intracapsular operation there are no tags of capsule or particles of the lens matter to stick between the edges of the corneal wound and inflammation is scarcely known, there is no after cataract and the patient continues to have better vision, while he would have a tendency to have poorer vision from the old operation on account of the great tendency of inflammation following the operation and also from thickening of the capsule.

How Far Can One Go With Safety?

If the lens does not present when the operator thinks he has made safe pressure he can abandon the intracapsular operation and cut the capsule with a cystitome or capsule forceps and deliver in the old method with the new technic. I would suggest the use of my capsule forceps if any are to be used, because they can be introduced without having the patient look down. No. 23.

When Should a Cataract Operation Be Performed?

In the intracapsular operation the lens can be removed as soon as the patient is unable to attend to his duties. The lens can be as easily removed at this time as any other, and he will be in better condition at this time than later.

Statistics

Some ophthalmic surgeons insist that statistics should be based upon a large number of operations and taken as they come. Many of the cases I operated in India had slight plus tension and a great many had dislocated lenses having been operated upon by a rowler. I believe these cases should not be included in making statistics, and if I could eliminate them my loss of vitreous would be 5.04 per cent and ruptured capsules 6.03 per cent. Taking the whole 576 cases there were 7.37 percent vitreous escape, 7.16 per cent bursted capsules. Three panophthalmitis, two hemorrhages of the choroid, four lenses shot out upon completion of the incision, and one lens was lost in the vitreous. The three cases of panophthalmitis would have occurred in any operation, because, in each case the patient had pulled the bandage nearly off of the eye probably testing his vision. The two hemorrhages of the choroid would have happened in any other method of extraction. The four lenses that shot out on completing the incision might have been avoided if the speculum had not been used. In the case where the lens was lost, I was to blame, not knowing how to introduce the spoon quickly enough.

Is Vitreous Loss Serious?

Loss of vitreous is not desirable and should it occur when using the speculum in delivering the lens in the old manner would be considered highly dangerous to vision. Loss of vitreous occurring in the Smith technic is nearly always slight, and a slight loss of vitreous is not considered of great danger to vision. In the 7.16 per cent of my 576 cases with escape of vitreous not over 2 per cent would be classed as dangerous and one-half

of these might have been avoided by eliminating the speculum. If the lens shoots out in 1 per cent of the cases when a man like Smith is holding the brow and doing all he can to prevent squeezing of the eye, we can expect a much higher percentage of such cases in less skilled hands. I am pleased to say that Smith will, in the future, recommend my lid retractor in place of any speculum for holding the eye open when the incision is being made, and my double lid hook for holding the upper lid away from the eyeball while the lens is being delivered and the toilet made.

Post-Operative Inflammation

The absence of inflammation after the intracapsular operation makes one soon lose sight of vitreous escape.

The Intracapsular Operation in India

Some ophthalmic surgeons have an impression that Smith does all the intracapsular operations that are done in India. In the Punjab where there are 20,000,000 inhabitants there are about 25,000 cataract operations performed a year and 90 per cent of them are intracapsular operations. Should Smith leave India tomorrow his operation would go on, because there are many competent operators in India doing it.

Shall We Accept This Operation?

Shall we adopt this operation now, or will we wait till we are compelled to? If the surgeons in India not claiming to be oculists can successfully remove the lens in its capsule, why can we as skilled ophthalmic surgeons not do the same. The only excuse I can see why we have not adopted the intracapsular operation is because of the objections I have mentioned, namely, the want of a trained assistant and of vitreous escape. I feel quite sure that we, as ophthalmic surgeons, need not go to India to learn to extract the lens in its capsule, but it would be better if all of us could have this large experience and be taught by an expert like Smith.

The Smith Technic in the Capsulotomy Operation

I believe that Smith's technic when used in the capsulotomy operation will do more for the cataract operation than all that has been done for it in the past one hundred years. If that technic is thoroughly mastered in the capsulotomy method a good operator will not have much difficulty in removing a lens in its capsule.

Where can a Doctor Go to See the Intracapsular Operation Demonstrated?

I feel quite safe in stating that any of the doctors who have worked in Smith's clinic will welcome any doctor to witness his operations if appointments be made. Among the doctors who have operated in Smith's clinic and are now removing the lens in its capsule are the following: Dr. Vail, of Cincinnati, Ohio; Dr. Timberman, of Columbus, Ohio; Dr. Meding, of New York; Dr. Dorland Smith, of Bridgeport, Conn.; Dr. King, of Cincinnati, Ohio. If the spoon delivery is mastered and the lid hook well understood before witnessing an intracapsular operation, much will be gained by a few operations and a competent ophthalmic surgeon would, in this manner, soon be able to remove a lens in its capsule.

Instruments

To remove a lens in any manner it is desirable to have an instrument that will hold the eye open and the lids away from the eyeball. I do not know of any instrument that will serve this purpose better than my lid elevator for holding the upper lid up while the incision and iridectomy is being made and my double lid hook for holding the upper lid up and

Fig. 18. Author's Lid Elevator and Double Hook, 2/3 Size.

Fig. 19. Smith's Modification of Dorland Smith's Knife, Exact Size.

Fig. 20. Smith's Hook, 2/3 Size.

Fig. 21. Smith's Iris Replacer, 2/3 Size.

Fig. 22. Smith's Spoon, 2/3 Size.

Fig. 23. Author's Capsule Forceps, 2/3 Size.

away from the eyeball while the lens is being extracted and the iris replaced. No. 18. A fixation forcep without a catch. A knife, and I have never seen a better than the Smith, No. 19, iris forceps; iris scissors, a small Smith hook for delivering the lens, No. 20, Smith iris replacer, No. 21, Smith's spoon for removing the lens after a slight loss of vitreous, No. 22, large dressing forceps for removing the capsule if it has burst as wells as remaining corticle. My capsule forceps to be used providing the lens cannot be extracted without too much pressure. No. 23.

A Word of Caution

I would urge in closing that ophthalmic surgeons contemplating the removal of a lens in its capsule master the Smith technic and use it in their old operation, and not attempt to remove a lens in its capsule until they have thoroughly mastered the Smith technic and have used it in many capsulotomy operations. When the lid is under control, the spoon delivery

mastered on animals' eyes and they have seen as many operations by the Smith pupils as is convenient, they will be quite ready to remove a lens in its capsule or out of it. Until one understands the Smith technic and fully understands how to hold the lid away from the eyeball and has a competent assistant, he should not attempt the removal of the lens in its capsule.

DISCUSSION

DR. DERRICK T. VAIL, Cincinnati, Ohio: Mr. President and Fellow Members: I cannot express the pleasure it gives me to be here tonight and participate in the discussion of this paper. Fisher wrote me to come and open the discussion, saying it was a duty I owed Smith. A duty to Smith shall always be a proud pleasure for me to perform.

Four years ago almost on this day I returned from just such a trip as Fisher took. What I saw there in Smith's clinic, then located at Jullundur, fifty miles south of Armitsar, has been exploited in numerous articles to the best of my ability. In all my articles thus far published, I only endeavored to relate to the profession how Smith did things. I have said nothing of my own work since returning home four years ago.

I know the technic of the old standard operation as well as anyone here knows it, having seen and practiced it for twenty years before I went to India, and I know the technic of Smith's operation as well as it need be known. I feel qualified, therefore, to speak and pass judgment on them both.

My verdict is best expressed in my work. I have entirely abandoned the technic of the old operation. I have not used a cystitome since my return from India four years ago. The cystitome is a poor instrument to use, not for what it does, but for what it does not do. I have scarcely any use for a discission needle.

But I would not deceive you into thinking that I extract in the capsule every time. I do it whenever it is possible in my hands to safely do. I shall explain why I do not extract every cataract in its capsule before I sit down. I want now to say a word about the operation as Smith does it.

The incision Smith makes is the best incision for cataract that has ever been devised. The principle involved in brief is that of an angle-hinge to a trap door, let us say. The fine point of the knife punctures the cornea at right angles to the limbus. The narrow blade is then turned flat in the plane of the iris and made to pass slowly through the chamber, but on emerging at the opposite side, the edge is turned up again to come out at nearly right angles to the limbus and is again turned flat so that the edge, staying within the cornea, severs it from the limbus with that one clean forward sweep. These two little angle-cuts at the ends of the incision speak volumes for allowing spaces for lens emergence. Thus it is, too, that Smith can cause an eye to disgorge a large lens through an apparently small incision with a minimum strain. The corneal incision opens, not like the jaws of a steel trap on its resisting hinge, but more like the jaws of a snake, whose articulations yield unresistingly.

As for the lid hook, I always use it in every cataract operation when delivering the lens and toiletting the wound. As for the lens hook, I use nothing else for delivering the lens. As for the lens spoon, it is a great instrument and works well. If I had Nur Ali, Smith's assistant, to help

me, I would not hesitate to use it whenever indicated. I shall refer to this again before I sit down.

Fisher's argument favoring operation on immatures is unassailable. I operate on every case, no matter what kind of a cataract it may be, if the vision is at best 20/70 or less. In fact, I like to operate on these cases; I do not dread it at all. I will say why. If vision is 20/70 or thereabouts, my patient is still in prime health. I can also dilate his pupil and study his fundus. It is a source of immense satisfaction to have seen the optic disc and macular region just before operation.

And now that we have sojourned to India and have paid just and well-earned homage to that prince of cataract operators, whose like the world has never seen, Lt. Col. Henry Smith, I. M. S., Armitsar, India, I will be excused if I say a word of eulogy for his quiet, dark-skinned assistand, Nur Ali.

Nur Ali has held the eyelids and brows and steadied the heads of over 30,000 cataract cases. He rarely speaks, goes about barefooted in the house, with his turban on and the cool white garments of a Mohammedan, quiet, unassuming, sober, trustworthy and as an assistant, peerless; not a doctor, not even a trained nurse, age perhaps 40, appearing and bearing himself with humility like a servant. You would hardly notice him; his work seems so trivial, so secondary and yet he possesses the key to uniform success in the operation. Thirty thousand cataracts, not to speak of as many more iridectomies and multiplied by ten in speaking of trachoma and other eye affections calling for skilled assistance, Col. Smith took him along when he transferred his activities from Jullundur to Armitsar, and I doubt not will take him to England when he resigns Indian service. Nur Ali assisted me in all my series of 358 extractions in India. I saw vitreous, a mere drop, in only 2 per cent of those cases.

You know now why the operation has been uncertain and difficult away from India. A faultless, skilled assistant is as essential as a good operator. We took the lock, but not the key; the bow, but not the string. There I stood operating at Jullundur, conscious of the brilliant cataract genius on my right, whose counsel guided me over the pitfalls, but totally unconscious of the no-less brilliant genius, the assistant on my left, whose hands are those of a wizard, whose judgment is quick and faultless, made so by years of practice among 30,000 cataract cases. The secrets of Smith I learned and learned well, just as Fisher and others have learned, but Nur Ali's secrets, shall I say his unconscious secrets, he still keeps. My excuse for not delivering every case in the capsule is Nur Ali.

If Fisher's new lid hook will eliminate the danger of an untrained assistant, he has conferred a priceless boom to Smith's intracapsular operation, and I pray it may be so.

DR. WM. L. NOBLE: As to the value of the operation, I am frank to say, I did not believe the operation could be put through to a successful conclusion with as little skill, you might say. It was so simple. While it seemed so simple, it called for a maximum amount of skill. Dr. Fisher mastered the technic, because he does not make any false motions. Every motion counts.

As to the ordinary operator, who is accustomed to operating in the old manner, what are we going to do about it? This is an interesting point for this society to determine.

Everything Dr. Fisher said about the double hook is justified; it increases the simplicity of the assistant's work.

As to the difficulty of placing the spoon behind the lens where the vitreous engages in the wound, I fail to see why it should be so very difficult. However, you might find it difficult if you were called upon to do it.

DR. H. H. BROWN:—To those of us who have been doing cataract work for twenty-five years, we cannot help but be impressed with the importance of Dr. Fisher's paper, and that surgery as applied to the extraction of the crystalline lens lacks something. The men who are doing conscientious work and a fair volume of work cannot help but be impressed with the fact that there is something lacking in the extraction of the crystalline lens from the eyeball. The presence of inflammatory involvements, accidents in the immediate operation, and the necessity for secondary operations, make those of us who are doing private practice feel sometimes as though we are woefully lacking in the results we are obtaining.

I am willing to be convinced; I want to be convinced. Of this operation in which I have had no experience, but from the experience of Smith and the gentlemen whom I know personally and the detailed accounts of their work, I feel certain that a new era is opening to us in the extraction of the crystalline lens from the eyeball.

DR. OLIVER TYDINGS: From the statistics of Lieut.-Colonel Smith, which are amply supported by those who have accepted the signal honor of an invitation to participate with him in this work, we must conclude that in his hands at least the intracapsular operation for the removal of a cataractous lens is the safest yet devised. In view of this fact the question which confronts every conscientious operator, whose fidelity to his patient's interest transcends every other consideration, which is the best operation for his patient? Colonel Smith and his co-workers have answered that and backed it up by statistics and testimony which cannot be gainsaid, but whether or not he can do this operation and throw around his patient those safeguards which will render this operation safer in his hands than any other, remains to be seen.

Let us look into the nature of these dangers of which we have heard so much; they all seem to center around the one fear of losing vitreous, and yet if we are to judge by the reports we have from different operators, they show about the same loss, whether the intracapsular or extracapsular method is used. The advantages gained in other things, such as freedom from post-operative inflammatory troubles, and after cataract is admitted by all without argument. Now, the question is, is it possible for a good operator to so protect his patient in this operation as to make him as safe or more so than by the older methods? To this I will say, yes, infinitely more safe.

Dr. Vail in his classical monograph, "Smith's Cataract Operation," has shown us step by step how this work is done. He has also pointed out to us the two sources of danger to the vitreous: First, the pressure of the lids upon the globe before the zonula is ruptured. Second, the faulty use of the spoon when the loss of vitreous is threatening. The pressure of the lids upon the globe, all will admit, we should be able to control. The advantage of Smith's method when loss of vitreous is threatened must appeal to all who have tried it. This is about the status of the operation up to 1914 as developed by Colonel Smith and so beautifully described and portrayed by Dr. Vail.

Now as a capstone to this work of art, Fisher has introduced some new features and added two new instruments which add greatly to the safety and simplicity of the operation: First, the lid retractor which he gave us ten years ago, the careful use of which aids in removing all pressure from the globe during the first part of the operation while the incision is being made, is too well known to you all to do more than emphasize the feeling of security which its use brings. The most recent advance is the double hook which most all of you will hear mentioned for the first time tonight. This replaced the single hook of Colonel Smith and does away with the necessity of a highly-trained assistant. The use of the double hook requires a perfect technical knowledge, but this can be obtained by intelligent nurses practicing upon one another, after one instillation of a 4 per cent solution of cocain. This technic must be acquired before the operation is undertaken. Another safety precaution introduced by Fisher different from the Smith technic is to have another nurse hold the brow so as to control the action of the muscles. This is done by the assistant in Smith's technic, but I think it is more easily accomplished by the Fisher technic, leaving him free to devote his entire attention to the operation. I have before spoken of Smith's technic in the use of the spoon where loss of vitreous is threatening. This technic is only gained by long practice and should be and must be acquired before danger is threatened. Human eyes are too sacred as well as too scarce to supply the need of the American surgeon. Fisher has pointed out a way in the use of a pig's eye, whereby this technic can be acquired.

This, I believe, will do more to popularize the operation than any other advances which have been made.

I would not say to every man who ventures to do a cataract operation, you must do the Smith-Fisher operation, but this I do say, that any man who proposes to do this work should familiarize himself with this technic, and thus be able to throw around his patient this additional security while doing the operation with which he is most familiar. I truly believe, if you will do this, in one year from now we will have as many ardent supporters of the intracapsular method as we have good operators.

DR. THOS. FAITH: I do not know of any other method of cleaning out the conjunctival sac better than using a lid hook and injecting bichloride of mercury solution into the conjunctival sac, being careful afterward to milk out the bichloride solution from the conjunctival sac by pulling the lids toward the external canthus and allowing it all to escape. Furthermore, the technic of extracting the lens seems to be far superior to the old method.

Another thing which appeals to me in connection with Smith's work is the incision.

It has been mentioned that bandaging the eye for seven or ten days is an unsurgical procedure. We do not attempt to extract the lens and operate on the eye without being reasonably sure that there is no infection present. It is not considered unsurgical to tie up or bandage any other wound and to keep on the bandage for several days, and why should it be unsurgical in the eye?

DR. GEORGE F. SUKER: I think it has been shown that the extraction of cataract is the most delicate operation known to surgery, and it has always appealed to me as being the height of perfection in operative work. The greatest drawback to cataract extraction is the capsule, much or little

that is left behind. It is always a bugbear, more or less. The only way to remove it is to remove the lens in its capsule.

The use of the speculum is the second drawback in cataract extraction. A third drawback for the extraction of cataract without the speculum is the ordinary Smith hook with which to withdraw the lids, which is unstable in the hands of the ordinary assistant. The new hook Fisher has today is the best lid retractor that can be made so far as I can see of any physical appliance. It so fixes the lid that it cannot get away. That being so and the lower lid being fixed, if you apply the technic of Smith, as demonstrated by Dr. Vail, Dr. Greene and Dr. Fisher, you will have as nearly an ideal operation as one can have if he does the capsulotomy with it. I had the pleasure of operating with Fisher's assistance a few days ago when the technic he has demonstrated tonight was employed, and it worked beautifully. I bandaged the eye according to his directions, and this afternoon could not see what I had done, but on removing the bandage, lo and behold I found I had a very nice and a very good result.

I think Fisher wants to impress upon us this thought: we should begin to employ the Smith technic with our capsulotomy, and after we have done a number of them then turn about and do the Smith operation.

DR. FISHER (closing the discussion): I wish to thank the members for the interest they have taken in this work, and it makes me feel that I would like to take another trip around the world.

I wish I could answer everyone who has taken part in the discussion, but it is impossible on account of the lateness of the hour, but I will say with emphasis, I would not advise anyone to attempt to do this operation until he has thoroughly mastered the new technic doing the old operation, for the reason that the first time he does it, should the result prove unsuccessful, he will likely blame the Smith operation.

THE INTRACAPSULAR AND THE CAPSULOTOMY OPERATIONS FOR SENILE CATARACT

Read by invitation before the Milwaukee Oto-Ophthalmic Society, March 21, 1916. Reprinted from Ophthalmology, July, 1916.

I appreciate the great honor the Milwaukee Oto-Ophthalmic Society has conferred upon me by its invitation to read a paper upon the extraction of a cataract in capsule, and I feel that I am assuming a very great responsibility in accepting it.

Your society would not be interested in a description of the classical operation of removing a cataractous lens after opening the capsule, but I believe all of you will welcome any suggestion that will lessen the complications following a cataract operation and offer better visual results.

In this short paper I will endeavor to point out the difference between the intracapsular operation, as performed by Lt. Col. Smith in Amritsar, India, with the author's modification of it, and the capsulotomy method. I am familiar with the complications that may follow the capsulotomy method because, I believe, I have experienced practically all of them.

Some operators seem to underestimate the danger to vision after a cataract operation by the capsulotomy method, and many magnify the complications when the intracapsular operation is performed. Having operated upon seven hundred eyes by the intracapsular method, one hundred of which were done in Chicago, it appears to me that I have had sufficient experience upon which to base an opinion regarding and recognizing its value. I feel that I am justified in comparing the two methods.

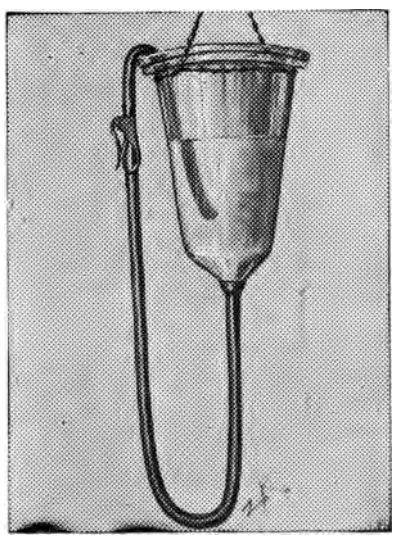

Fig. 1. Irrigator.

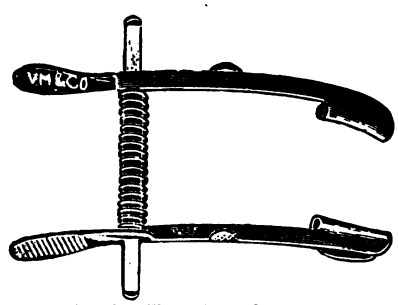

Fig. 2. Eye Speculum.

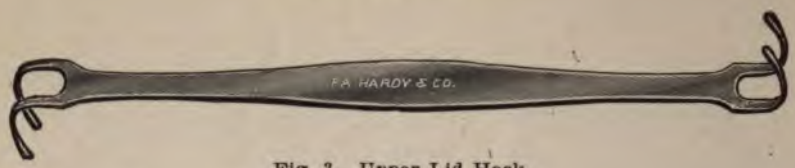

Fig. 3. Upper Lid Hook.

Fig. 4. Lower Lid Hook.

Preparation of the Patient: The preparation of the patient for a cataract operation is the same in either operation except that I use cocain only twice in the intracapsular, while most operators in the capsulotomy method use it more often.

Cleansing of the Conjunctival Sac: In the usual operation the speculum is used, and the eye is flushed with boric solution by means of an eye dropper, whereas in the intracapsular operation the lids are held away from the eyeball with retractors and three ounces of a warm solution of 1 to 2000 bichloride of mercury is allowed to flow into the conjunctival sac from an irrigator suspended two feet above the patient's eye. (Figures 1, 2, 3, 4, 5, 6.)

Fig. 5. Beard's Ophthalmology.

Fig. 6.

Fig. 5. Capsulotomy Method: The eyelids are held apart by a speculum while the eye is flushed with a boric solution by means of a medicine dropper. The advantage that the lid hooks offer for cleansing the conjunctival sac can be seen by comparing with Fig. 6.

Fig. 6. Intracapsular Method Exposing the Entire Conjunctival Sac: The lids are held away from the eyeball and flushed with three ounces of bichloride solution 1-2000 from the irrigator, which has a great advantage over the method of cleansing the conjunctival sac, represented in Fig. 5.

Fig. 7. Beard's Ophthalmology.

Fig. 8. Beard's Ophthalmology.

Fig. 7. The Incision Capsulotomy Method: The speculum is holding the lids apart, resting lightly upon the globe while the incision is being made.

Fig. 8. Capsulotomy Method: A continuation of Fig. 7. If the operator hurts the patient or because of fright or any other reason, the patient squeezes his eyelids the speculum may press upon the globe and cause great damage before it can be removed. By comparing Fig. 7 and 8 with Fig. 9 and 10 it is plain to see that one of the greatest sources of danger has been eliminated by discarding all kinds of specula when operating for cataract by any method.

In the capsulotomy method the eyelids are usually held open by an eye speculum (Figures 7 and 8), while in the intracapsular operation the retractors are used (Figures 9 and 10).

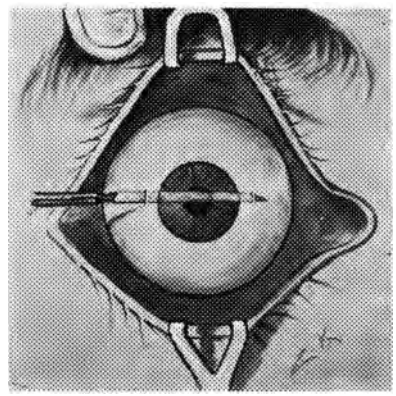

Fig. 9.

Fig. 9. The Incision Intracapsular Method: An assistant is standing in the correct position, on the left side of the patient, holding the upper lid up with author's double hook in his right hand and the lower lid down with author's lower lid hook in his left hand. A second assistant or nurse is holding up the brow with the thumb. In this position the first part of the incision is made.

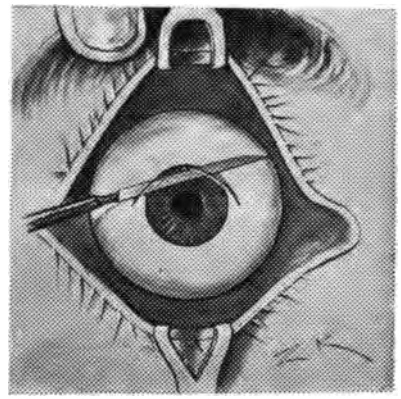

Fig. 10.

Fig. 10. Intracapsular Method: A continuation of Fig. 9. The incision is being finished. It is practically impossible for the patient to produce any pressure upon the globe while the incision is being made, or during any part of the operation that is to follow. Compare Figs. 7-8. This part of the technique can be used to advantage in removing a lens by any method.

In either operation the operator makes as good an incision as he can. Some prefer a conjunctival flap; others make the incision entirely of the cornea. The principal object in either operation is to get a deep puncture and counter-puncture, in order that a large opening may be made for easy lens delivery.

The corneal incision is not as difficult for beginners as is a conjunctival flap, and can usually be made by skilled operators with one sweep of the knife. The conjunctival flap does not seem to have any advantage over the corneal section, and has some disadvantages. With either, union is usually prompt unless delayed by too frequent dressing.

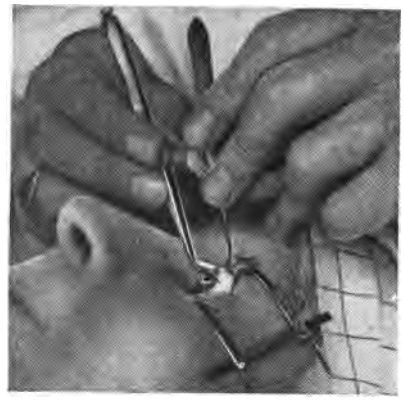

Fig. 11. Beard's Ophthalmology.

Fig. 11. The Iridectomy Capsulotomy Method: The iridectomy is usually made with the speculum holding the eye open and the patient looking down, when the iris forceps introduced closed, opened in the eye, the iris grasped, pulled out, and cut with scissors. Some operators cut the iris without fixing or holding the eye, which has its dangers, because the patient may look up and cause the forceps to be pushed into the lens; the iris may be torn, or he may squeeze his eye and cause the speculum to do irreparable damage. This method of cutting the iris necessitates the introduction of one more instrument into the eye than is required in the intracapsular method. Compare with Fig. 12.

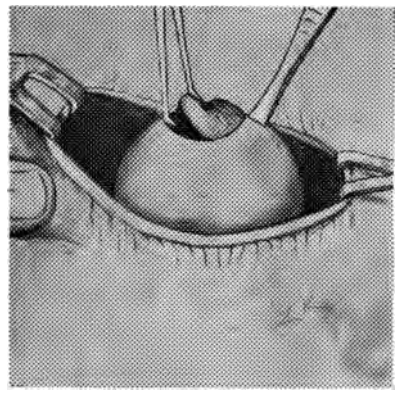

Fig. 12.

Fig. 12. Iridectomy Intracapsular Method: The eye is held open with the author's retractors in the same manner as when the incision was made. An assistant grasps the eye gently with forceps and holds it steadily while the operator places a Smith iris forceps without teeth perpendicularly upon the cornea. The upper blade is placed just above the corneal incision and the lower just below the upper edge of the pupil, when a little pressure is applied upon the lower blade which is brought upward, pushing the iris out when the two blades come together, the iris is caught, gently pulled out, and cut with scissors. It is practically impossible for the patient to cause any trouble at this time, while, in the iridectomy described in Fig. 11, a serious accident might occur from pressure of the speculum or by a movement of the eye. One less instrument is introduced into the eye and a fair trial will demonstrate its worth. Compare with Fig. 11.

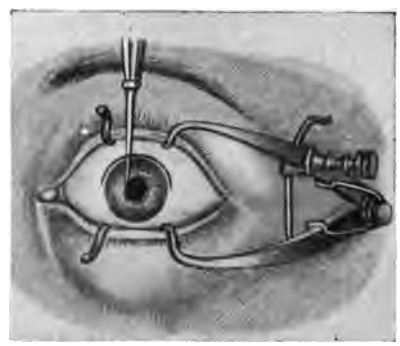

Fig. 13. Beard's Ophthalmology.

Fig. 13. Capsulotomy: In the capsulotomy method the capsule is now cut with the cystitome, or a piece of it is removed by capsule forceps, whereas in the intracapsular operation this part of the technique is omitted and one less instrument is introduced into the eye.

Fig. 14. Beard's Ophthalmology.

Fig. 15. Beard's Ophthalmology.

Lens Delivery: In the capsulotomy method the lens is removed by pressure after the capsulotomy has been made (Figures 14 and 15).

Fig. 14. Capsulotomy Method: Delivery of the lens by capsulotomy method with the lids held apart by a speculum. The patient must look down in order that any instrument can be placed above the corneal section, with the operator standing behind the patient's head. This is very difficult for some patients to do because the natural tendency is to look up when the eye is being operated upon.

Fig. 15. A continuation of Fig. 14. Should the patient make pressure upon the globe at this time, or a loss of vitreous occur from any cause, the speculum must be removed, and the lids held away from the globe in some other manner. This is a very awkward situation, providing the lens has not been delivered. Compare with Figs. 16-17-18.

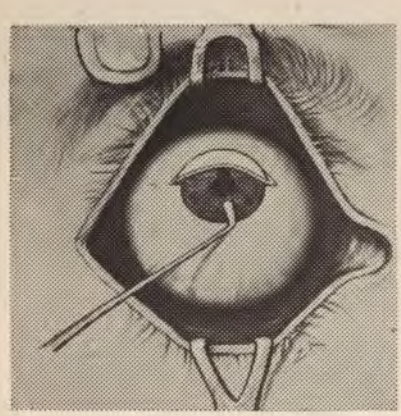

Fig. 16.

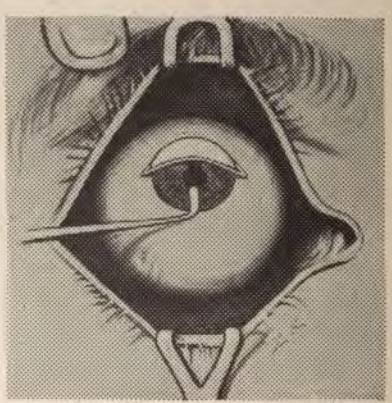

Fig. 17.

Fig. 16. Lens Delivery Intracapsular Operation First Position: Immature Cataract: The lids are held away from the eyeball as when the incision was made. The capsulotomy has been omitted and pressure is being made with a small tenotomy hook directly backward towards the optic nerve. The zonula has broken above and the lens is presenting in the corneal incision.

Fig. 17. Intracapsular Operation: Immature Cararact: A continuation of Fig. 16. The lens is advancing, pressure is being made continuously toward the optic nerve. When the lens has passed the equator it does not require any more pressure and is hooked out as in Fig. 18.

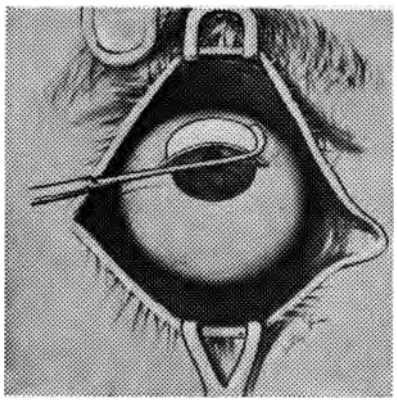

Fig. 18.

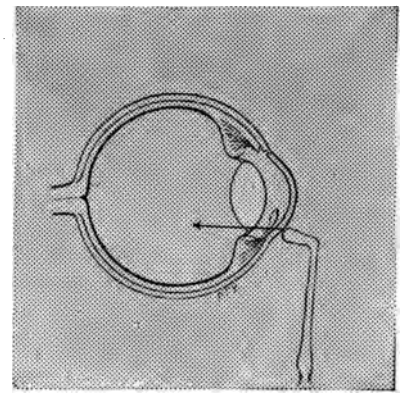

Fig. 19.

Fig. 18. Intracapsular Operation: A continuation of Fig. 17. The lens is hanging in the corneal wound when all pressure is removed, the point of the hook is directed upward to keep it from engaging in the incision. The hook is now pulled across the corneal wound under the lens, completing the delivery.

Fig. 19. Intracapsular Operation: Drawing by Dr. Vail. A cross section showing the direction of the pressure in the upright delivery or when operating upon immature cataracts. Compare 16, 17, 18 with 14 and 15 and note the danger that might be caused by the speculum, especially when it is necessary to make the patient look down, which of itself is dangerous. It is not necessary for the patient to look down in the intracapsular operation.

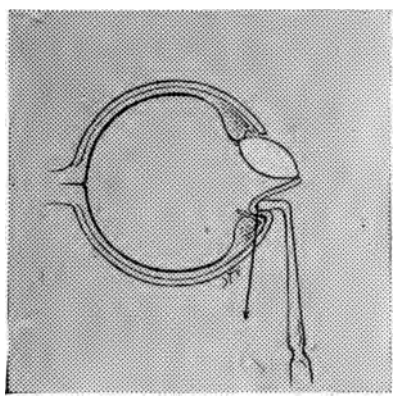

Fig. 20.

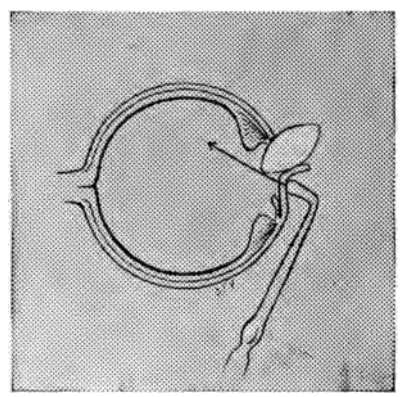

Fig. 21.

Fig. 20. Intracapsular Operation Tumblers: Drawing by Dr. Vail. First position in the intracapsular operation when the lens is mature or hypermature and it is desirable to break its zonula below, turn it over, and let it come out upside down. It would be practically impossible to successfully remove a lens in this manner with the lids held by an ordinary eye speculum. All pressure must be kept away from the globe. The point of the hook is caught on the ciliary ridge and the pull is made downward, until the zonula has broken below and, when the lens has turned over, the pressure is changed from a pull down to a slight push up, tucking the cornea under the lens, Fig. 21.

Fig. 21. Drawing by Dr. Vail. A continuation of Fig. 20. The cornea is pushed under the lens and, when it is hanging in the corneal wound, all pressure is removed and the lens removed as in Fig. 18.

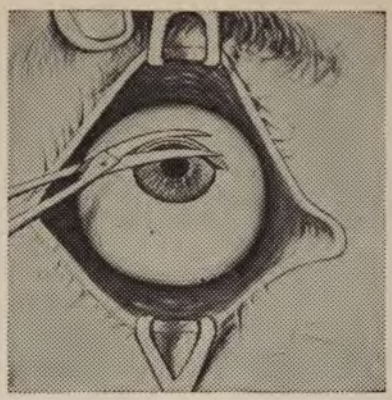

Fig. 22.

Fig. 22. Prolapse of Vitreous after the Lens has been Delivered: Intracapsular Method: The lids are held away from the globe by the author's retractors in the same manner as when the operation was begun, the lens has been delivered, a loss of vitreous has occurred, and is being cut off with scissors. The lids must be held away from the globe while this is being done. When this is finished, the patient is requested to close his eyes with the hooks under the lids. When the eye is closed, the hooks are removed; the upper one first. With the lids held away from the globe in this manner a slight loss of vitreous after lens delivery does not usually cause complications. Loss of vitreous is rare when the lids are held in this manner and, when it occurs, the operation can be finished without changing instruments. When this accident occurs in the capsulotomy method with the speculum holding the lids, it must be removed, and the lids held in some other manner. Some vitreous will be lost removing the speculum, and some more while inserting some form of retractor under the upper lid, but, if the author's hooks are used from the beginning of the operation until it is finished, this complication will be minimized.

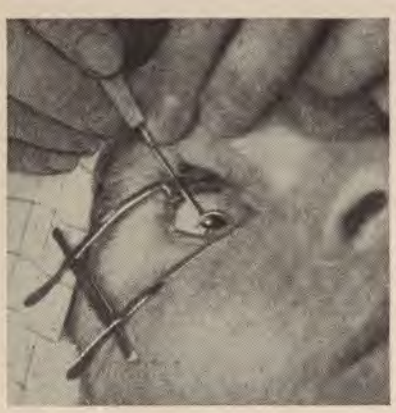

Fig. 23. Beard's Ophthalmology.

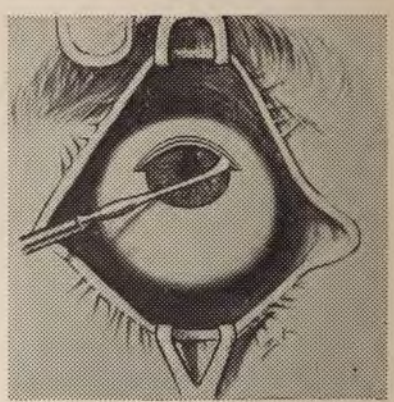

Fig. 24.

Fig. 23. Toilet Capsulotomy Method: The lids are being held away from the eyeball with an eye speculum and the patient is requested to look down, when the iris replacer is passed into the corneal wound and the iris is tucked back. The fact that the patient must look down is sufficient to make the toilet difficult because the iris is forced into the incision but, when the patient looks up, it is released. Compare it with Fig. 24.

Fig. 24. Toilet Intracapsular Operation: All pressure is removed from the globe by author's lid hooks in the same manner as when the operation was begun, the patient usually looks up and, if not, he is requested to do so when the iris replacer is passed into the incision, the iris is pushed away from the puncture and counter-puncture and the patient is requested to close his eyes with the hooks under the lids. When the lids are closed, the hooks are removed, the upper one first and the eyes bandaged. The iris is more readily replaced when caught in the edges of the wound if the patient is looking up, than when looking down, as in the capsulotomy method, and there is much less danger of vitreous loss. Compare with Fig. 23.

Fig. 25.

Fig. 25. Capsulotomy Method Loss of Vitreous Preceding Lens Delivery: Loss of vitreous occurring any time during a cataract operation is considered by most operators as a complication to be feared; but, if vitreous appears before the lens has been delivered, the complication is very much more serious, because more vitreous will be lost in extracting the lens. When such an accident occurs in the capsulotomy method, the speculum must be removed and the lids held in some other manner, because, it would be disastrous to attempt its removal with the speculum in place. More vitreous will be lost when removing the speculum and still more when introducing a retractor, or having the assistant hold the lids with his fingers. Whichever method is employed, if a loop is inserted into the eye to remove the lens, much vitreous is usually lost and such a condition is justly considered of very grave import. Compare Figs. 27-28.

Fig. 26. Smith-Fisher Instrument.

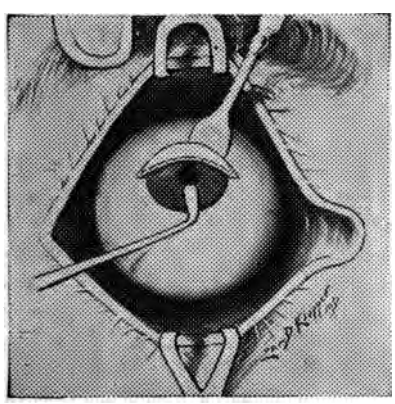

Fig. 27.

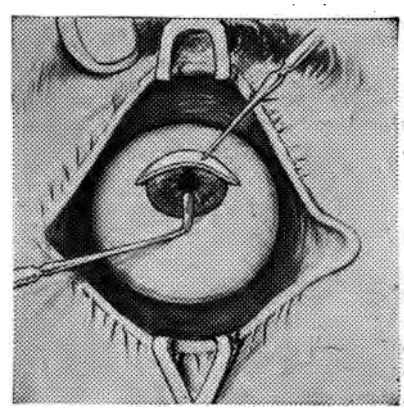

Fig. 28.

Fig. 27. Smith's Method with Author's Modification of Operating when Vitreous Precedes Lens Delivery: If loss of vitreous preceding lens delivery has occurred in the intracapsular operation, the lens is delivered by the Smith method with the lids held away from the globe by author's retractors, the same as in the beginning of the operation. Pressure of the hook is removed, the Smith spoon, Fig. 26, is passed down behind the lens and pressure is then made with the hook upon the spoon toward the optic nerve, when the lens is made to slide up the spoon and out. Compare this technique with that of the removal of a lens with the loop.

Fig. 28. Author's Method of Operating When Vitreous Precedes Lens Delivery: Loss of vitreous preceding lens delivery has occurred in the intracapsular operation, the lids are being held away from the globe by author's lid hooks, the same as when the operation began. The author's needle, Fig. 26, which was held in the left hand waiting for such an accident, is stuck into the edge of the lens, and, with just a little pull upward, together with slight pressure upon the cornea with the hook, the lens either comes out in capsule or the capsule ruptures.

The Bandage and After Treatment by the Capsulotomy Method: After the capsulotomy method, both eyes are usually bandaged for twenty-four to forty-eight hours, at which time the operated eye is inspected, and, if all is well, it is flushed with boric acid solution, 1 per cent atropine is instilled, the eyes are rebandaged and redressed in the same manner daily till the bandage is omitted, usually from the unoperated eye about the fourth or fifth day, and from the other a week later. If a prolapse of the iris is found at the first dressing after the capsulotomy operation, it is usually cut off.

The Bandage and After Treatment, Intracapsular Operation: After the intracapsular operation both eyes are covered with carefully prepared yellow oxide ointment (eight grains to the ounce) squeezed out of a tube, a sterile dressing, composed of sixteen thicknesses of gauze cut to cover both eyes and with a notch for the nose to prevent slipping, is applied and over this a starch bandage without making any pressure, after which the patient is put to bed the same as after the capsulotomy method.

When the starch bandages has set, or becomes dry, it may be too tight, or too loose, and should be cut under the ears and the two ends stitched together. If too tight, it is made looser, and, if too loose, it is tightened. If the patient does not complain, the bandage is not disturbed until the ninth day after the operation, when, if all has gone well, the wound will be closed and it may be discontinued and dark glasses prescribed.

The dressings may be changed any time they become displaced or are uncomfortable; but no good and much harm may follow the inspection of the eyeball. Too frequent dressings are undesirable and when changes are necessary strict surgical cleanliness must be observed.

The bandage should be removed from the unoperated eye if the patient becomes delirious and, if he cannot see with the unoperated eye, the bandage must be removed from the one operated upon. It is not necessary that patients remain in bed nine days after the operation, but it is desirable that both eyes should be bandaged that long. They may walk to the toilet as often as necessary after twenty-four hours have elapsed after the operation and may be allowed to sit up part of each day.

If a prolapse of the iris is noted at the first dressing on the ninth day after the operation, it is not cut off as would usually be done after the capsulotomy method; but the eye is rebandaged for four more days, when the protruding portion is cut off. The eye must not be held with fixation forceps when this is done, because any sudden movement of the eyeball while being held during the cutting might open the wound and invite infection. If at any time the patient complains of pain and it is necessary to remove the bandage, a fresh one should be applied with the same care as after the operation unless the lids are swollen, when it is advisable to inspect the eye and, if infected, steps should be taken to combat it; but the less the eye is inspected the less often will infection occur.

Complications During Extraction: Ophthalmic surgeons are all familiar with the complications that may occur when a cataract operation

is performed by the capsulotomy method, and these same complications may accompany the intracapsular operation.

When a lens is removed by the capsulotomy method, post-operative inflammation and secondary operations are much too frequent; but when the intracapsular operation is performed these complications are practically absent.

Why Do Most Operators in the United States Prefer the Capsulotomy Method: The proposition is a very simple one. It is impossible to successfully perform an intracapsular operation unless the whole technique is adopted, and, if a competent operator attempts the removal of a lens in its capsule without understanding Smith's technique or having a good working knowledge of the author's lid hooks, the Smith spoon and author's needle, he will soon come to grief; because anyone thus beginning the removal of a lens in capsule will have an abnormal number of cases where vitreous presents before the lens is delivered, and, if he is not master of this complication and must resort to the old method of removing the lens with a fenstrated loop, he cannot be expected to successfully perform the intracapsular operation.

I believe that operators of large experience, as well as beginners, would increase their average vision if they would adopt the intracapsular operation in all cases of senile cataract, providing they would discontinue the use of eye specula, and familiarize themselves with the new technique as I have described it in a paper read before the Chicago Ophthalmological Society, March 15, 1915, and published in Ophthalmology, July, 1915, entitled: "A New and Safe Technique for the Cataract Operation."

Conclusions: The Smith technique with the author's modifications has many advantages over the capsulotomy method, and mentioned in the order of operating, are:

1st. Less cocain, which is an advantage.

2nd. Flushing of the conjunctival sac with 1-2000 bichloride of mercury, the method of application of which needs only a trial to be convincing.

3rd. The incision in the cornea has many advantages and easier to perform.

4th. The iridectomy as performed and original with Smith has great merit, because the iris forceps is not inserted into the eyeball and should appeal to all.

5th. Capsulotomy, with its complication, is omitted.

6th. The lens delivered in capsule is one of the greatest achievements in ophthalmic surgery. Most operators have done it accidentally, but Smith should have the credit for developing a safe technique.

7th. If a prolapse of vitreous occurs, intracapsular technique offers the safest method for its treatment.

8th. The toilet is a very important part of the technique and has many advantages, if made by the intracapsular method, because all pressure is removed from the globe, and when the patient looks up toilet is facilitated.

9th. Removal of the lens when vitreous has been lost, or is presenting, is infinitely safer in the intracapsular than by the capsulotomy method.

10th. Removing the bandage and inspecting the eye too early often results in complications.

11th. Last, but one of the greatest advantages of the intracapsular operation, is that it is not necessary for the patient to be blind before opera-

tion; unripe or immature senile cataracts are easier of extraction than ripe or mature ones, and offer better vision; because they can be operated before the patient is blind, when his health and spirits are good.

Finally, I believe that every point in the Smith technique, with the slight modifications I have made, could be adopted in the capsulotomy method and increase the average vision after cataract operations, whether performed by experienced or inexperienced operators, and if the technique is mastered, many lenses will be removed in capsule that are now operated by the capsulotomy method.

The technique of holding the lids can be mastered upon cocainized human eyes, and that of the author's needle, Smith's spoon, the incision and the iridectomy upon four weeks' old kittens' eyes, which have a cornea about the size of that of human eyes, and are probably the best substitute possible. The cat's eyes must first be removed and placed in a mask, because they are too deeply set to be operated upon. There seems no valid reason why any operator cannot familiarize himself with the intracapsular technique, as has been described, before attempting to operate upon human eyes. One of the greatest obstacles to the intracapsular operation has been the misunderstanding of the technique, especially that of the removal of the lens when loss of vitreous was imminent or actually had occurred.

When a cataract is removed in its capsule, the best operation that could have been done has been performed, the patient being practically free from danger of infection and post-operative inflammation. As it will not be necessary for him to have a secondary operation, he may look for his vision to be good and remain so; whereas, if the capsulotomy operation had been performed, it is often necessary to do a secondary operation, and even after that he cannot be assured that the opening in the capsule will not close.

NINETY-FOUR CONSECUTIVE INTRACAPSULAR CATARACT OPERATIONS

Read by invitation before the Mississippi State Medical Society, May 12, 1916.
Reprinted from The Journal of Ophthalmology and Oto-Laryngology, August, 1916.

A report of ninety-four selected intracapsular operations with their visual results would not be considered a severe test of the method because of the cases having been selected; but the results of that number of consecutive cases should be sufficient to determine the value of the operation.

Smith and his students claim to be able to successfully remove lenses in their capsules and insist that they get better visual results than is possible by the capsulotomy method, that post-operative inflammation is rare, and that needling is unnecessary. Some operators object to the operation and claim that loss of vitreous and post-operative inflammation are the rule; but such is not the case if the operation is properly performed.

If the operator does not understand the Smith technique, a loss of vitreous preceding the delivery of the lens must be common and, if the lens is then removed by the old method, complications and post-operative inflammation must be expected.

Smith has been criticised because he has not given the visual results of all of his operations; but he has done so in a large number of cases. "His colossal work, including more than 35,000 cataract operations, has never been equalled and probably never will. Besides, he has performed more surgical operations than any other man living."[1] Our great surgeons have a large number of assistants and trained nurses, while Smith does all this work with two native medical graduates serving as internes, one trained nurse, and less than a dozen native attendants, none of whom has ever had any medical training. It is not uncommon to see 250 cataract patients in the hospital any day during the busy season with both eyes bandaged, waiting for the ninth day, when the bandage is removed for the first time, and ninety per cent of them are discharged with corneal wounds closed, no post-operative inflammation and with useful eyes. It is not necessary for him to see them again, and why should we demand that he give us the visual result of this colossal work?

It is impossible and useless to report the visual results of this great work—impossible because many live hundreds of miles away and are instructed to get glasses from the nearest place where they are sold in about six weeks from the time they are dismissed from his hospital. It is my custom, and I presume that of many others, to give their patients similar instruction.

It would be useless for Smith to see his patients after the corneal wound was closed, because the lens had been removed in its capsule and nothing more could be done. He dismisses a cataract patient when the wound is closed, the same as general surgeons do after any surgical operation.

Smith has done well: he has given us the best technique, and we should not be unreasonable with him; but he cannot give the visual results of all

1. Lt. Col. Henry Smith—Ophthalmic Record, September, 1915.

of his work. The profession can, however, ask and expect of Smith's students to give a full report of all of their operations performed at home, because it is not only possible, but a simple matter.

It would be utterly impossible for me to give the visual results of the 576 operations I performed in India under the guidance of Col. Smith; but I have reported the results up to the time that the corneal wound was healed and the patient discharged.[2]

If the profession were familiar with Smith's work in India and knew how much he has accomplished with so little assistance, they would marvel at his system. An average day in the busy season for Smith may be interesting.

The Hindus, Mohammedans and Christians have different days in the week to observe as the Sabbath, and as Smith is a Christian, he must work on his Sunday and also that of the Hindus and Mohammedans. He, therefore, labors seven days a week, leaving home about nine-thirty every morning after ministering to some private patients there, who sit outside under the trees for a waiting room.

His duties before going to the hospital are numerous: in court as an expert witness in medico-legal work, at the morgue to examine any body that has been brought in during the night, and where he is often expected to give an opinion as to the cause of death. He arrives at the office of the hospital about 10:30 and devotes about thirty minutes to the examination of candidates for service in the police or military department and to other duties regarding the hospital.

About 11:00 he arrives at the clinic room, where a crowd awaits him. Standing at the door, he examines the patients as they pass, sending the cataract patients to one side of the operating room, the iridectomies to the other, where they sit upon the floor, as they do not use chairs, the lid and minor eye cases to an adjoining room for his assistants to care for, and the general surgical cases to yet another room.

About 11:30 he is ready for the operations and the cataract work is begun. These patients are all taken from the street without any preparation, and many of them have traveled long distances and probably have not slept the night before. Three patients are placed upon separate tables, the eyes are thoroughly cleansed, cocainized with one instillation of a four per cent solution of cocaine and in three minutes the operation is begun. When finished, the patient's eyes are bandaged and they are carried to their cots, where they remain nine days.

In the busy season an average of twenty-five cataract operations are performed daily, as are about ten iridectomies for glaucoma and operations for opacities produced by trachoma. After the eye work is finished the general surgical work is begun, and any operation may be expected from the minor cases to the greatest surgical operations.

The day's work is completed about 5:00 and the greatest ophthalmic operative clinic in the world is finished, as is one of the greatest surgical clinics.

I have made some slight modifications in Smith's operation in order that it can be performed by operators who cannot possibly go to India to receive instruction from him.[3]

2. Fisher—Ophthalmology, April, 1914.
3. Fisher—Ophthalmology, July, 1915.

The profession is entitled to a report of all the senile cataracts I have operated since returning from India, not of selected cases only, but the results of my ninety-four consecutive operations, with visual results as determined by the physicians referring them to me. A few of the cases operated from my clinic were assigned to some member of the staff for the report of the visual results.

The cases are numbered, not according to the date of operation, but according to the visual results obtained, in order that one can tell at a glance how many received normal vision, how many had useful vision, and how many had total loss. The causes for visual results of those having less than 20/40 are given.

Fifty of the following operations have previously been reported.[4]

No.	Name	Age	Lens	Eye	Referred by	Result
1.	S. B.	57	Immature	R. E.	Dr. Thomas Faith Chicago	20/15
2.	Dr. O. H. B.	57	Immature	R. E.	Dr. H. A. Childs Creston, Iowa	20/15
3	Dr. J. F. C.	63	Immature	R. E.	Dr. J. R. Newcomb Indianapolis, Ind.	20/15
4.	Dr. J. F. C	63	Immature	L. E.	Dr. J. R. Newcomb Indianapolis, Ind.	20/15
5.	O. H.	57	Immature	L. E.	Dr. A. E. Otto Alexandria, Ind.	20/15
6	S. H.	65	Mature	R. E.	Dr. O. Munk Kendallville, Ind.	20/15
7.	J. B.	75	Mature	L. E.	Dr. J. M. Williamson San Francisco, Cal.	20/20
8.	P. N.	56	Immature	R. E.	Dr. H. W. Woodruff Joliet, Ill	20/20
9.	E. C.	82	Immature	R. E.	Dr. H. W. Woodruff Joliet, Ill.	20/20
10.	H.B.	46	Immature	R. E.	Dr. Harry Gradle Chicago	20/20
11.	J. M.	73	Mature	R. E.	Dr. Harry Gradle Chicago	20/20
12.	J. M.	73	Mature	L. E.	Dr. Harry Gradle Chicago	20/20
13.	J. M.	78	Mature	L. E.	Dr. Harry Gradle Chicago	20/20
14.	J. M.	57	Immature	L. E.	Dr. J. R. Hoffman Chicago	20/20
15.	A. L.	34	Immature	R. E.	Dr. J. R. Hoffman Chicago	20/20
16.	A. L.	34	Immature	L. E.	Dr. J. R. Hoffman Chicago	20/20
17.	S. M.	42	Immature	R. E.	Dr. O. Yarnell Decatur, Ill.	20/20
18.	W. C. K.	57	Immature	R. E.	Dr. A. S. Treat Sharon, Wis.	20/20
19.	H. P. G.	59	Immature	L. E.	Dr. J. M. Williamson San Francisco, Cal.	20/20
20.	Mrs. B.	37	Immature	R. E.	Dr. J. M. Williamson San Francisco, Cal.	20/20
21.	A. R.	47	Immature	R. E.	Dr. J. M. Williamson San Francisco, Cal.	20/20
22.	Rev. H.	73	Mature	L. E.	Dr. F. H. Langhorst Elgin, Ill.	20/20
23.	Wm. B.	51	Immature	R. E.	Dr. C. L. Barber Lansing, Mich.	20/20

4. Fisher—Annals of Ophthalmology, October, 1915.

No.	Name	Age	Lens	Eye	Referred by	Result
24.	Wm. B.	51	Immature	L. E.	Dr. C. L. Barber Lansing, Mich.	20/20
25.	L. H. H.	54	Immature	R. E.	Dr. N. J. VanMeter Linden, Iowa	20/20
26.	L. H. H.	54	Immature	L. E.	Dr. N. J. VanMeter Linden, Iowa	20/20
27.	H. H. A.	41	Immature	R. E.	Dr. G. H. Mundt Chicago	20/20
28.	H. H. A	41	Immature	R. E.	Dr. G. H. Mundt Chicago	20/20
29.	Rev. V.	71	Immature	R. E.	Dr. J. R. Hoffman Chicago	20/20
30.	J. P. H.	75	Mature	R. E.	Dr. J. R. Hoffman Chicago	20/20
31.	Mrs. A.	57	Mature	R. E.	Dr. O. K. Thompson Chicago	20/20
32.	M. K.	50	Immature	R. E.	Dr. E. A. Kusel Oroville, Cal.	20/20
33.	M. K.	50	Immature	L. E.	Dr. E. A. Kusel Oroville, Cal.	20/20
34.	Mr. J.	58	Immature	R. E.	Dr. A. Stapler Chicago	20/20
35.	F. W.	71	Mature	L. E.	Dr. W. C. Converse Chicago	20/20
36.	C. A. M.	67	Immature	L. E.	Dr. J. A. Herve Milwaukee, Wis.	20/20
37.	J. D. P.	55	Mature	L. E.	Dr. J. B. Hughes B. & O. R. R., Chicago	20/20
38.	Mrs. E. H.	69	Immature	R. E.	Dr. T. S. Conover Flint, Mich.	20/20
39.	G. E.	67	Immature	R. E.	Rev. W. Huelster Elgin, Ill.	20/20
40.	Mrs. K.	60	Mature	R. E.	Dr. Fisher's clinic	20/20
41.	Mrs. C.	47	Immature	R. E.	Dr. H. M. Starkey Rockford, Ill.	20/20
42.	Mrs. McI.	81	Mature	R. E.	Dr. S. G. West Chicago	20/20
43.	Mrs. E.	70	Mature	L. E.	Dr. Fisher's clinic	20/20
44.	Miss W.	52	Mature	R. E.	Dr. Fisher's clinic	20/20
45.	A. D.	73	Immature	R. E.	Dr. J. R. Davey Chicago	20/20
46.	Dr. J.	64	Immature	R. E.	Dr. R. P. Jennings Hot Springs, S. D.	20/20
47.	G. T.	48	Immature	R. E.	Dr. W. A. Kiefer Sleepy Eye, Minn.	20/20
48.	H. D.	82	Immature	L. E.	Dr. J. A. Valentine Dixon, Ill.	20/20
49.	Dr. C.	62	Immature	L. E.	Dr. M. C. Twitchell Burlington, Vt.	20/20
50.	J. W. S.	60	Immature	L. E.	Dr. A. L. Hägler Springfield, Ill.	20/20
51.	Mr. K	68	Immature	L. E.	Dr. T. S. Conover Flint, Mich.	20/20
52.	Dr. K.	63	Mature	R. E.	Dr. J. Buzik Chicago	20/20
53.	Mr. A.	66	Mature	L. E	Dr. A. S. Treat Sharon, Wis.	20/20
54.	E. J.	44	Mature	R. E.	Dr. A. S. Treat Sharon, Wis.	20/20

No.	Name	Age	Lens	Eye	Referred by	Result
55.	Mrs. B.	65	Mature	L. E.	Dr. G. H. Mundt Chicago	20/20
56.	Mrs. O. S.	57	Mature	L. E.	Dr. F. A. Wiley Earlville, Ill.	20/20
57.	Dr. J.	64	Immature	L. E.	Dr. R. D. Jennings Hot Springs, S. D.	20/25
58.	S. M.	42	Immature	R. E.	Dr. O. Yarnell Decatur, Ill.	20/25
59.	O. N.	79	Mature	L. E	Dr. Fisher's clinic	20/25
60.	Dr. W.	52	Immature	L. E.	Dr. W. F. Weese Ottawa, Ill.	20/30
61.	J. A.	69	Mature	R. E.	Dr. J. R. Hoffman Chicago	20/30
62.	A. Z.	74	Mature	R. E.	Dr. Fisher's clinic	20/30
63.	Sister M. E.	56	Immature	L. E.	Father H. P. Gallagher Santa Barbara, Cal	20/30
64.	Mrs. S.	49	Immature	R. E.	Dr. J. M. Williamson San Francisco, Cal.	20/30
65.	Mrs. McI.	81	Mature	R. E.	Dr. S. G. West Chicago	20/30
66.	Dr. L.	52	Immature	R. E.	Dr. R. C. Lyons Naylor, Mo.	20/30
67.	Mrs. B.	72	Immature	R. E.	Dr. H. G. Mundt Chicago	20/30
68.	J. P.	76	Mature	R. E.	Dr. Fisher's clinic	20/30
69.	J. D.	73	Mature	R. E.	Dr. H. N. Lebensohn Chicago	20/40
70.	A. R.	47	Immature	R. E.	Dr. J. M. Williamson San Francisco, Cal.	20/40
71.	Mrs. U.	56	Immature	R. E.	Dr. G. W. Lowry Hastings, Mich.	20/40
72.	J. C.	57	Mature	L. E	Dr. J. R. Hoffman Chicago	20/40
73.	J. W. H.	60	Immature	R. E.	Dr. Fisher's clinic	20/50
	Glaucoma beginning two weeks after leaving hospital.					
74.	Mr. S.	72	Mature	R. E.	Dr. Fisher's clinic	20/50
	Glaucoma two months after operation.					
75.	C. C.	50	Immature	L. E.	Dr. J. R. Hoffman Chicago	20/50
	Central Choroiditis.					
76.	C. A.	71	Mature	R. E.	Dr. L. V. Fairhall Danville, Ill.	20/50
	Ruptured and retained capsule.					
77.	W. E. E.	77	Mature	R. E.	Dr. C. E. West Decatur, Ill.	20/60
	Choroiditis, myopia 8 D.					
78.	F. W.	70	Mature	R. E.	Dr. W. C. Converse Chicago	20 65
	Detached choroid.					
79.	Mrs. N.	72	Mature	R. E.	Dr. H. W. Woodruff Joliet, Ill.	20/70
	Central Choroiditis.					
80.	R. N. A.	49	Immature	R. E.	Dr. H. W. Woodruff Joliet, Ill.	20/70
	Operated at Illinois Charitable Eye and Ear Infirmary; records state that bandage was removed the ninth day, wound healed, no post-operative inflammation, but no other record except vision 20/70.					
81.	M. K.	60	Immature	R. E.	Dr. H. M. Lebensohn Chicago	20/70
	Operated at Illinois Charitable Eye and Ear Infirmary; records state that bandage was removed the ninth day, wound healed, no post-operative inflammation, but no other record except vision 20/70.					
82.	M. S.	39	Immature	L. E.	Dr. A. Z. Albro Chicago	20/80
	Atrophy Optic Nerve.					
83.	A. N. A.	67	Immature	R. E.	Dr. Fisher's clinic	20/80
	Glaucoma six weeks after operation.					

No.	Name	Age	Lens	Eye	Referred by	Result
84.	H. B.	79	Immature	R. E.	Dr. J. H. Hutton, Chicago	20/80
	Central Choroiditis.					
85.	T. O.	80	Mature	R. E.	Dr. Fisher's clinic	20/100
	Temporary insanity, iridocyclitis, fellow eye lost by the capsulotomy method.					
86.	N. S.	49	Immature	L. E.	Dr. J. M. Williamson, San Francisco, Cal.	20/100
	Nystagmus, eye was never normal, operated for squint when a child.					
87.	Mrs. N.	72	Mature	L. E.	Dr. H. W. Woodruff, Joliet, Ill.	20/200
	Central Choroiditis.					
88.	J. D.	58	Immature	L. E.	Dr. J. R. Hoffman, Chicago	20/200
	Detached retina.					
89.	Mrs. T.	70	Mature	R. E.	Sister M. Edith, Chicago	20/200
	Glaucoma ten days after leaving hospital.					
90.	Mrs. E. H.	69	Immature	L. E.	Dr. T. S. Conover, Flint, Mich.	20/200
	Ruptured capsule, did not return for needling.					
91.	J. P.	76	Mature	L. E.	Dr. Fisher's clinic	20/200
	Ruptured and retained capsule.					
92.	Mr. McK.	70	Mature	L. E.	Dr. C. L. Barber, Lansing, Mich.	0
	Detached Choroid. Left hospital ten days after operation, eye quiet, impossible to complete history.					
93.	S. B.	57	Immature	L. E.	Dr. Thomas Faith, Chicago	0
	Hemorrhage of choroid, iridocyclitis. Right eye is No. 1 with 20/15 vision.					
94.	O. R.	83	Immature	L. E.	Dr. Andrew Wessels, Houghton, Mich.	0
	Vomited for two hours five hours after operation, iridocyclitis.					

SUMMARY NINETY-FOUR CONSECUTIVE OPERATIONS

20/15, six; 20/20 or better, fifty-six; 20/25, three; 20/30, nine; 20/40, four; 20/50, four; 20/60, one; 20/65, one; 20/70, three; 20/80, three; 20/100, two; 20/200, five; lost eyes, three (including the incomplete history of No. 92.

Causes of Poor Vision.—Iridocyclitis, 3; glaucoma, 4; choroiditis, 5; ruptured capsule that did not return for needling, 3; detached choroid, 2, one of which retained 20/65, the other one, No. 92, left hospital ten days after operation and further records could not be obtained. The corneal wound was closed, iris normal, tension normal, the eye quiet at the first dressing on the ninth day, and he had not complained of any pain. It is reported in the summary as lost. Optic atrophy, 1; temporary insanity, 1; hemorrhage of choroid, 1. Drawn up pupil sufficient to be lowered, 1; detached retina, 1; the three that had retained capsule might have been improved if they could have been needled.

The losses were not due to the method of operating and could not have been avoided. No. 92, detachment of the choroid was found at the first dressing the ninth day after operation. The corneal wound had healed, the anterior chamber reformed, no prolapse of iris, and no inflammation. He left the hospital the tenth day after the operation and, as it is impossible to get further records, the case is reported as lost. No. 93 was caused by hemorrhage of the choroid. No. 94 vomited five hours after the operation and it continued two hours.

The foregoing visual results seem sufficient to give the intracapsular operation first place among the various methods. Of these ninety-four cases 58 were immature cataracts and 36 mature; 56 received 20/20 or bet-

ter, 38 of these being immature and 18 mature; 5 of the 6 receiving 20/15 were immature.

Conclusion.—It is the writer's opinion that all senile cataracts, whether mature or immature, would receive better visual results if operated by the intracapsular than by the capsulotomy method, and this report justifies the assertion that it is not necessary to wait for cataracts to become mature, that post-operative inflammation is rare, infection practically nil, and that the author's modification of the Smith technique has practically eliminated vitreous loss.

DISCUSSION

DR. CHAS. HUFF DAVIS, Knoxville, Tenn.: Mr. President and Gentlemen, it gives me a peculiar pleasure to have the honor to open the discussion of Dr. Fisher's paper, before your society, for the reason that I have seen Dr. Fisher in this operation and have acquired the technique myself under his teaching.

The one thing that attracted my attention to the operation and made me most ambitious to acquire it was the fact that no more do we embarrass ourselves by telling the patients to come in for observation from time to time while they approach blindness. The economic value of this operation is a wonderful thing. In this work-a-day life there are very few of us who have the normal ambitions of life to educate and fit children for life work who can well afford to lose the returns of his earning capacity, which loss is involved in long waits for the cataract to get ripe. With this Smith operation the patient is operated upon when he is at his best physical condition. He has not had time to develop nerves, to impair his digestion and to suffer all the physical inconveniences due to a life of inactivity pending his long wait and wasting finances.

Post-operative infection rarely follows intracapsular cataract extraction. The secondary operation is not necessary. You who do the conventional cataract extraction know that needling has to be done with disgusting frequency at a subsequent time. There is less danger of infection. Visual results are better.

The profession, I think, is greatly indebted to Dr. Fisher for certain instruments bearing his name, which make for safety. For instance, his lid hooks are very ingenious devices, taking the bugbear from the danger of the operation, and even if one be so benighted as not to acquire this new and safe technique, these lid hooks are of inestimable value, even in the conventional cataract extraction, for the reason that most eyes are lost by the patient squeezing his lids at a critical time. With these lid hooks, squeezing of the lids is practically eliminated. I might suggest in this connection that for an examination of the retrotarsal folds and of the fornix above and below these instruments furnish the best possible means for a complete and distinctive view. An assistant should have some coaching in their use, and Dr. Fisher, in his various reprints, has given the technique of the assistant in very clear language, which is easily understood and easily acquired. I acquired it in forty minutes. The bugbear of the Smith operation has always been the contemplated loss of vitreous. To meet this unfortunate complication, Dr. Fisher has devised a needle, the technique of which he has explained. I believe this device is the only instrument ever devised for the specific purpose of protecting against loss of vitreous. Dr. Fisher was a guest of the Knox County Medical Society of Tennessee about

a year ago, at which time he held a clinic at the Knoxville General Hospital, during which there were six cataract extractions. His sanguine statement that we would not lose any vitreous was almost humorous to a person who had seen many cataract extractions, but during this entire clinic there was not one drop of vitreous lost, and not one of the hospital patients suffered any pain or inconvenience during the time of repair. The youngest of the operated cases was forty-eight, and the oldest of the tender years of ninety-two.

Reference has already been made to better visual results in this operation. The subject of Dr. Fisher's essay at Knoxville was "Fifty Consecutive Cataract Extractions by the Intracapsular Method." This essay was impressive, because each case was reported in a very convincing manner, with dates, age, sex, and by whom referred, and the uniformly good vision of 20/20 simply strikes a new song in cataract surgery.

It is my firm conviction that this operation will become the operation of choice in ophthalmic surgery, and I believe that every beginner should be taught this instead of what might be termed the conventional operation, for the reason of the advantages I have mentioned and by virtue of the fact that the technique has been made safe by Dr. Fisher's devices. All beginners should operate freely on animals' eyes. When I was interne in the Illinois Eye and Ear Infirmary we had access to pigs' eyes and did muscle operations galore upon dogs. In a discussion with Dr. Fisher he has suggested certain interesting facts about the eyes of the cat. This appealed to me to be very interesting, on account of dimensions of the cornea, etc. I would like for Dr. Fisher, in closing his discussion, to go into detail as to his ideas and ideals as to the availability of cats' eyes for beginners to learn this technique.

DR. GEO. E. ADKINS: Cataracts are never emergencies. They can be operated tomorrow, next week, next month, or in the next several months just as well as today. This being the case, I can see no need of a doctor attempting an operation that he only does occasionally and one which involves so much responsibility.

DR. FISHER (closing): Many will agree with Dr. Adkins, because it seems nearly impossible to acquire a technique for a cataract operation on account of the lack of opportunity to acquire it. It is impossible to get any experience in the work by taking post-graduate work. The only experience obtainable is witnessing others operate, and eyes are too precious to experiment upon. I will endeavor to point out a way to obtain the technique by answering Dr. Davis.

The usual method of teaching the technique of a cataract operation is upon animals' eyes, principally that of the pig; but such instruction is usually unsatisfactory, because the pig's eye is not like the human.

I have lately been teaching the technique by using the eyes of four-week-old kittens. The kitten's cornea at that age is about 12 mm. in diameter and quite like the human. I have found these eyes far superior to those of any animal that I have ever used, and quite available. In large cities they can be purchased at stores where birds and animals are sold. In the country, kittens could be easily procured, and, as a last resort, if an operator is ambitious, he could raise them.

Note.—No. 60 was operated March 21, 1916, and when this paper was read his vision was 20/30 with +6.00. He returned with glaucoma June 12, 1916, twelve weeks after the operation, with vision reduced to 20/100.

Nos. 23, 24, 31, 32, 33, 37 have been refracted since this paper was read and all have 20/15.

Consideration of the foregoing articles in connection with the description of the author's Modification of the Smith-Indian Operation for Senile Cataract beginning on page 32, will show clearly the steps taken to make it meet American conditions and to remove the one great objection to it—the fear of loss of vitreous.

TRAUMATIC CATARACT IN THE ADULT

When a cataract is produced in a subject under twenty the treatment is not necessarily the same as if in an adult and there are certain dangers to the vision if a cataract is produced in one over twenty that might not follow if the subject were under that age. Needling for congenital cataract in children is not usually attended by serious inflammation, but if the same thing were done to an eye of an adult it would be quite likely to be followed by serious inflammation.

Iritis, cyclitis, uveitis and secondary glaucoma might follow and if the lens matter were not removed the vision that might have been saved would have been destroyed. The removal of a traumatic cataract in an adult is considered a serious operation, but it is often a more serious matter not to remove it. The care of an adult with traumatic cataract must be based upon the following conditions:

First: The extent of the injury.

Second: The location of the injury.

Third: Time of injury before first aid.

Fourth: Cause of the injury.

Fifth: Non-penetrating wounds.

Sixth: Penetrating wounds.

THE EXTENT OF THE INJURY.—Must be determined before any treatment can be outlined. The injury may be only slight, but just enough to have produced an opacity of the lens and what is sometimes termed conservative treatment or waiting developments is followed.

If the injury is so extensive as to preclude all possibility of saving any vision, or even the eyeball, such a case should be given every opportunity for counsel, because delay would enable him to obtain such counsel to decide upon the treatment and would not be adding any danger to the case. It is desirable in all such injuries to have counsel that the patient may have the benefit of it, because a delay of a day or two in a recent injury cannot possibly injure his good eye.

THE LOCATION OF THE INJURY.—Much will depend upon the location of the injury. If the injury is confined to the cornea the danger of complications is not so great as if it extends into the sclero-corneal junction or back of it into the ciliary body or even back of that into the choroid.

The nearer the injury is to the ciliary body the more serious must it be considered, yet wounds in the ciliary body often heal as promptly as in other parts of the eye, providing they are properly cleansed and covered with a sliding conjunctival flap.

TIME OF INJURY BEFORE FIRST AID.—The treatment of a traumatic cataract is often determined by the time elapsing between the injury and the first examination. If seen early and the eye is extensively injured much would naturally be done that could not be attempted if the wound had united with the iris protruding.

If the injury had been slight, but producing a traumatic cataract, and several days had elapsed, the treatment would be determined by the condition of the eye at the first examination.

CAUSE OF INJURY is very important in determining the treatment of traumatic cataract. If the injury was caused by a penetrating instrument, the treatment is not always the same as if produced by a non-penetrating one.

NON-PENETRATING WOUNDS

NON-PENETRATING WOUNDS: Producing traumatic cataracts often cause the surgeon to hesitate and wait developments. Such delays should not be of long duration, but in any traumatic cataract in an adult, the patient is better served if the lens is removed early or, at least, before any danger could follow from swelling of the lens.

Non-penetrating wounds producing opacity of the lens are treated as follows: If the eye is seen soon after the injury and the lens is practically opaque, two drops of a one per cent solution of atropin should be instilled into the eye every four hours, and as soon as the lens is completely opaque it should be removed. It is imperative that it be removed before the eye becomes hard, because after that time the danger of complications is increased.

A traumatic cataract in an adult should not be left for nature to absorb it, because if the lens is not removed, but watched, the treatment will be long drawn out and the patient deprived of chances of vision he would have by early removal of the cataractous lens.

With the improved method of surgical cleanliness and of holding the lids away from the eyeball and the discarding of the speculum, the removal of a lens is not as serious a matter as was formerly supposed. The removal of a traumatic cataract and its after care after non-penetrating wounds is the same as after penetrating wounds and will be fully described under treatment of penetrating wounds.

PENETRATING WOUNDS

PENETRATING WOUNDS are necessarily more serious than non-penetrating, because of the added danger of infection, but their treatment is usually more exact and the surgeon has certain principles to follow that are not always encountered in the non-penetrating wounds.

If the injury was caused by a penetrating wound and the substance was iron or steel, it would be imperative that the foreign body be removed at once; but, if the perforating injury was caused by a nail, a long piece of wire or some substance that was not retained in the eye and the eyeball was soft, the removal of the lens should be deferred until the eye had regained its tension.

Perforating wounds producing traumatic cataract may be classed clinically as those that have been made by substances that are attracted to a magnet and those that are not. Substances that are not attracted by a magnet will be classed as non-metallic and those that are attracted by a magnet as metallic.

NON-METALLIC substances which produce injuries to the eye, causing traumatic cataract, can only be removed when they can be seen, grasped with forceps and removed. The treatment of the cataract will be the same as if produced by a metallic substance and will be described under that subject.

METALLIC FOREIGN BODIES causing traumatic cataract can sometimes be successfully removed with a magnet, the removal of which will be described under magnet operations. Traumatic cataracts occurring in persons over twenty have a great tendency to produce tension from swelling of the lens and loss of vision from iritis, cyclitis, uveitis and glaucoma if the lens is not removed before such swelling occurs.

A traumatic cataract that is produced by iron or steel entering the eyeball requires that an opening be made large enough to remove the lens at the same time the foreign body is removed, but in eyes that do not require opening early to remove a foreign body, the removal of the lens may be deferred until such a time as is expedient, provided that the swollen lens does not injure the eye by tension.

A lens should not be removed if the injury is so great as to destroy the vision and, if the perception and projection is abolished, no good can be expected from its removal, but as soon as the tension is normal in a traumatic cataract, the lens should be removed, providing perception and projection are good, because delay will only add to the complication.

TECHNIQUE OF REMOVING TRAUMATIC CATARACT: If the case is recent, the tension not low (unless produced by metal and when the metal and lens are to be removed at once), the eye and face are thoroughly cleansed, a few drops of a four per cent solution of cocain is dropped into the eye and, after three minutes, another instillation, after which ten drops of a two per cent solution of cocain is injected under the conjunctiva above and below the limbus.

Three minutes after the injection the operation is begun with the same precaution as though an operation for senile cataract were to be performed. An assistant holds the lids away from the eye in the same manner as described in operations for senile cataract, page 35.

FIRST STEP: An incision is made in the upper third of the cornea with a cataract knife or large keratome, the section being made slightly smaller than when operating for senile cataract, making the puncture and counter-puncture entirely in the cornea and completing the incision in it.

SECOND STEP: As large a piece of capsule as is possible is removed with the author's capsule forceps, which can be used while the patient is looking up, which has many advantages when operating for traumatic cataract.

Fig. 69. Author's Capsule Forceps.

THIRD: The lens will now be removed by slight pressure on the cornea from below or, sometimes better, by slight pressure from above by placing a grooved director above the upper lip of the wound and making pressure backward, causing the wound to gap. As much of the lens matter is removed in this manner as can be safely done, which is usually so much that the remainder will be absorbed.

Some operators wash out the anterior chamber, but others believe it is safer to remove as much of the lens as can be done safely by manipulation and that which is left will not usually cause glaucoma from swelling.

FOURTH: The eye is now closed after a four per cent atropin ointment has been introduced, the lid hooks not being removed until after the eye is closed.

FIFTH: The lids of both eyes are now covered with two per cent yellow oxide ointment squeezed out of a tube, and the eyes covered by sixteen layers of gauze, a bandage applied over both eyes without pressure, as is described on page 43.

SIXTH: It is well to put the patient to bed for a day or two on a light diet with one grain blue mass pill and seven and one-half grains of urotropin four times daily.

After the bandage is removed from the unoperated eye, the operated one is protected by a protector as after an operation for senile cataract, described on page 45.

This protector being held with adhesive strips, can be raised up or down, four per cent atropin instilled three times daily and the protector kept on for nine days or until the corneal wound is closed and the anterior chamber reformed. Favorable cases can leave the hospital in two weeks, but if the lens is not removed early, tension will usually be increased and all kinds of complications may be expected.

If the lens is removed as above described, the patient can usually resume his work in about four weeks with as much or more vision than he would have had by waiting, even though glaucoma had not appeared.

Again, if the lens is removed early, the case is either dismissed before the time of sympathetic inflammation could appear or the vision has been lost and the eye removed.

In any event the case is usually discharged in a month, with better chances of vision than by waiting. Complications are treated by atropin, dionin, laxatives, mercury, large doses of salycilate of soda, leeching the temple, hot applications, if they can be given clean, and the general treatment recommended for injuries. If infection follows, the eye is usually lost, but not because of removing the lens, but as an accompaniment of the injury. Twenty drops of cyanide of mercury injected deeply in the orbital tissue is reported by some as of value in infections.

If a traumatic cataract is seen for the first time several weeks after the injury, the time for swelling of the lens has passed because the swelling follows soon after the injury, after which absorption occurs and the danger of glaucoma from swelling has passed.

In such a case the safe procedure would be watchful waiting. If it seemed that the danger of swelling had passed and the absorption was not fast enough, the lens should be needled. Many needlings may be necessary, and if the patient resided a long distance from his oculist, as is often the case, the delay and waiting would be tiresome.

To emphasize the importance of early removal of the lens, the author will give the histories of four cases, two where the lenses were removed with a good result, one where the patient was seen, for the first time, nine weeks after the injury, was kept in the hospital with repeated needling, until he became discouraged and returned to his home dissatisfied.

The fourth patient was treated expectantly for four weeks, and when the author saw him in consultation, the eye was steamy and hard, there was no perception or projection and the removal of the lens would have been useless.

No. 1. J. J., aged 36. Injured by piece of iron or steel striking him in the eye. The morning after the accident the magnet successfully removed a small piece of steel that had passed through the lens into the vitreous. The incision in the cornea was made not only large enough to remove the steel, but to permit removal of the lens matter, all of which was extracted that could be removed with safety.

He was discharged from the hospital two weeks from the time of the injury, was seen as an out patient for two weeks more and resumed his work four weeks from the time of injury. His vision, with correction, was 20/30.

No. 2. E. E., aged 26, was injured by a long piece of wire striking him in the eye causing a traumatic cataract. He came under my service the morning following with a shallow anterior chamber: T.-2. The eye was cleansed surgically, four per cent atropin solution instilled, bandaged, put to bed and four per cent atropin instilled three times daily. One grain

blue mass pill was given three times a day and seven and one-half grains urotropine four times daily.

The third day after the injury the tension was normal, perception and projection good, and the lens was removed and treated in the same manner as case No. 1. He left the hospital in two weeks, resumed his work at the end of 4 weeks from his injury. Vision, with correction, 20/60. The poor vision was due to the scar in the cornea caused by the injury.

Case 3. Injured by being hit in the eye by a nail. Was treated by his oculist in the hospital four weeks and called at the doctor's office daily for three weeks and every other day for two weeks more.

The author saw him nine weeks after the injury with the tension normal and the lens partially absorbed. He was placed in the hospital and watched and when it was decided a needling could be safely performed it was done and repeated as often as seemed necessary and just as often closed up.

He left for home discouraged after nine weeks of this kind of treatment, which was eighteen weeks from the time of his injury. Ultimately he may have some vision, but, if the case had been operated at once, as were Nos. 1 and 2, the convalescence would have been quicker and more satisfactory.

Case 4. P. P., aged 55, was injured and treated expectantly for three weeks when he was seen in consultation by the author. His eye was stony hard, there was no perception or projection and the eye was hopelessly lost. This case might have been saved if the lens had been removed early. The above four cases are only reported to emphasize the importance of early removal of the lens in traumatic cataract.

Magnetic foreign bodies in the eye can sometimes be seen if a traumatic cataract has been produced and the foreign body is in the lens, but if it has passed through the lens we can only guess it is in the eye from the symptoms and history of the case.

If a patient is seen with a history of having been struck in the eye by a small piece of flying metal and presenting a cut in the cornea, with an opaque lens, a cut or tear in the iris, and the tension of the eye minus, we may infer that the foreign body is in the eye and there would be no harm in preparing the patient for a test with the giant magnet.

The patient is placed in front of the magnet after the eye has been cocainized and the tip is placed in the center of the cornea and an attempt is made to bring the metal back through the lens into the anterior chamber, where it can readily be removed. If the patient experiences pain from the application of the magnet and the foreign body is not seen, it must be in the eye and a further attempt should now be made to remove it.

Emphasis is made upon this point, because some operators have X-ray pictures made and others have the foreign body localized before applying the magnet. The author prefers to use the magnet first in recent injuries

when the metal has passed through the lens, because no matter where the foreign body has lodged, pulling it back through the lens will be the safest route if it can be done.

If the metal is diagnosed by the magnet on account of pain by its application, the next step is to remove it.

Cocain is injected under the conjunctiva, above and below, the same as if operating for senile cataract (page 35). The incision is made large enough to remove metal and lens, capsule forceps are used and all the operating that is necessary to be done is done at this time. Four per cent atropin ointment is used and the eye closed and treated the same as outlined on page 113.

If the foreign body has been in the eye a long time, an X-ray picture or a localization is indicated, because the time for swelling of the lens and infection have passed, and there is no necessity for haste in removing the foreign body, which is quite a different proposition from a recent case.

Roentgen pictures or exact localization of foreign bodies is the systematic practice of many, but others believe that in a recent case where the foreign body has passed through the lens that there is no contraindication of removing or attempting its removal at once as described above.

HAND MAGNETS: Are often desirable in removing foreign bodies, especially when they are in the anterior segment of the eye and can be seen or have been brought from the vitreous into the anterior chamber by the giant magnet. The hand magnet or magnets, as there are a number of good ones, are much more readily manipulated than the giant magnet. Gradle of Chicago has recently produced a hand magnet that seems to have great power and can be easily manipulated.

Whatever magnet is used, if it be powerful, can be regulated providing it has a rheostat. Giant magnets are provided with rheostats and are under the control of the operator, the only advantage the hand has over the giant magnet is its being more readily manipulated.

CONGENITAL CATARACT

It is unnecessary to describe the methods of diagnosis of congenital cataract to ophthalmic surgeons, because anyone familiar with the ophthalmoscope will not have any difficulty in diagnosing opacities of the lens.

It seems also unnecessary to classify congenital cataracts except from a clinical standpoint, and as this work is intended as a clinical guide, the only class of congenital cataracts that will be discussed are those that are immature and those that are mature.

IMMATURE CONGENITAL CATARACT

These are by far the most common and the ones usually brought to the ophthalmic surgeon. There are certain fixed steps in the management of these cases that must be observed if all that is possible is to be done for these little ones. When opacities of both lenses are found in a child and a diagnosis of congenital cataract is made, certain fixed steps must be followed and if a systematic examination is made, one will rarely give his patient poor advice. The same steps are taken in a systematic examination of all patients with congenital cataract.

FIRST: The vision is taken and recorded in the same manner as would be followed in refracting any one.

SECOND: Glasses should be tried in the same manner as though the congenital cataracts did not exist. If the child accepts glasses which improve the vision, say, from an abnormal vision which is not of practical value to good working vision enabling the child to read and have useful eyes, glasses are prescribed and no other treatment given. Such is the case of many little ones with congenital cataract and it is quite a simple proposition to satisfy them.

THIRD: If the child will not accept glasses that will improve the vision or does not give useful practical vision, one-half per cent solution of atropin is prescribed, two or three drops to be instilled into each eye four times a day, cautioning the parents to hold a handkerchief at the inner corner of the eye and make a little pressure to keep the medicine from running down into the nose, which might produce toxic symptoms.

The parents are requested to return with the child after using the medicine three days, when the pupils will be found widely dilated, at which time the refraction should be gone over again. If the vision can be made better at this examination than at the first one with a small pupil, the same vision can be expected from either removing the lens or by making an iridectomy downward.

The advantages and disadvantages of needling as compared with iridectomy seem to require no argument. When a lens is needled, two pairs of glasses are required, one for distance and one for near, but the pupil is round and the eye is not disfigured, because it looks normal; but when

the iris is cut it disfigures the eye, and the only advantage of the iridectomy is that the patient does not require two pairs of glasses until the presbyopic age.

The author contends that it is wrong to make a child appear conspicuous and for that one reason he does not recommend an iridectomy in any case, but prefers to remove the lens.

FOURTH: When a child's vision is taken and recorded and it does not accept any glass, atropin is given and then, if glasses cannot be found that will improve the vision, the case is considered as one that will not be benefited by either glasses or operation.

This constitutes the treatment of partial congenital cataracts.

To emphasize the treatment, let us suppose a child aged 11 with

R. 20/200 + 3.00 = + 1 cy ax 90 20/20.
L. 20/200 + 3.00 = + 1 cy ax 90 20/30.

Such a case needs only glasses.

Case 2. Aged 11. R. V. 20/200, L. V. 20/200. Glasses will not benefit. A one-half per cent atropin solution is prescribed, when vision is found, after three days, to be

R. 10/200 + 3.00 = + 2.00 c 90 20/30.
L. 20/200 + 3.00 = + 2.00 c 90 20/30.

If such a case is needled, these glasses, with about + 10 added will give vision of 20/30, which is practical vision, and the operation is recommended.

Case 3. Aged 10. R. V. 20/200, L. 20/200. Glasses will not improve, atropin is prescribed when the pupils dilate well beyond the peripheries of the opacities, permitting a good view of the fundus with the ophthalmoscope, and glasses cannot be found that will give better vision than 20/200, or the starting point. In such a case, glasses will not benefit and an operation will not be satisfactory.

MATURE CONGENITAL CATARACTS: These cases form a slight minority, but they are brought early because the parents can readily see that there is something wrong with the pupils because of their being white instead of black. It is not necessary to dilate the pupil except for the satisfaction of determining how far toward the periphery the opacity extends.

From a clinical standpoint it can be seen that the capacity covers the entire pupil and the only chance for improvement would be to needle or remove the lens. Either of those procedures will likely prove successful providing the pupil contracts and dilates to light. It would seem harsh

to mutilate such eyes or make them unsightly if vision can be restored by needling or removing the lens, and it can.

The question of age is important, but it is not necessary to operate before the child is a year old or older. The pupils should be kept dilated during convalescence after the lens is needled or removed.

TECHNIQUE OF OPERATION for CONGENITAL CATARACT: It is a common practice among many to needle congenital cataracts and, after absorption has taken place, to make an opening in the capsule. Some, however, including the author, prefer to do a more extensive operation by first making an incision including about one-third of the cornea and then, after removing a piece of the capsule with capsule forceps, removing as much of the lens as can be done with safety.

This operation is usually without inflammation and often the one operation is all that is necessary, the iridectomy being omitted, leaving a normal-appearing eye. Atropin should be instilled for a short time three times daily. For those living at a distance from the operator it has many advantages.

If an iridectomy is made downward, as recommended by many, and later the lens becomes opaque, it must be removed and the iridectomy would only make the eye unsightly.

PRECAUTIONS: If the needling operation is selected, there can be no danger of vitreous loss, a speculum can be used and an assistant is not necessary; but if an incision is made in the cornea, and the capsule forceps are used, it is necessary to have an assistant to hold the lids away from the eyeball in the same manner as described where an operation for senile cataract is to be performed, a full description of the technique of which is described on page 35.

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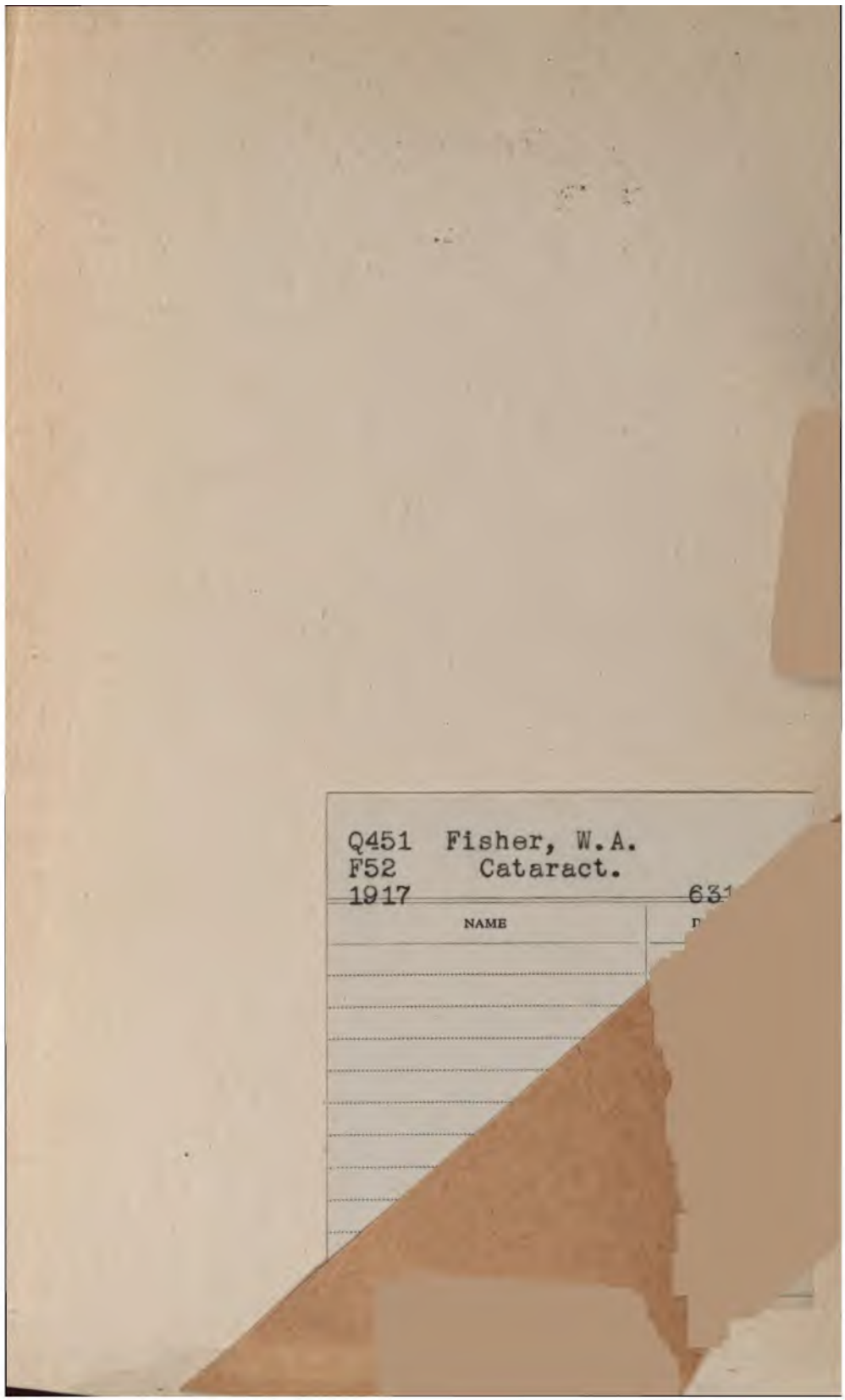
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